Nokia Customer Care

Service Manual

RM-57/58 (Nokia 6681/6682)
Mobile Terminal

Part No: 9239169 (Issue 1)

Company Confidential

Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
Issue 1	04/2005	J-AK	

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IMPORTANT

This document is intended for use by qualified service personnel only.

Warnings and cautions

Warnings

- IF THE DEVICE CAN BE INSTALLED IN A VEHICLE, CARE MUST BE TAKEN ON INSTALLATION IN VEHICLES FITTED WITH ELECTRONIC ENGINE MANAGEMENT SYSTEMS AND ANTI-SKID BRAKING SYSTEMS. UNDER CERTAIN FAULT CONDITIONS, EMITTED RF ENERGY CAN AFFECT THEIR OPERATION. IF NECESSARY, CONSULT THE VEHICLE DEALER/ MANUFACTURER TO DETERMINE THE IMMUNITY OF VEHICLE ELECTRONIC SYSTEMS TO RF ENERGY.
- THE PRODUCT MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES, FOR EXAMPLE, PETROL STATIONS (SERVICE STATIONS), BLASTING AREAS ETC.
- OPERATION OF ANY RADIO TRANSMITTING EQUIPMENT, INCLUDING CELLULAR TELEPHONES, MAY INTERFERE WITH THE FUNCTIONALITY OF INADEQUATELY PROTECTED MEDICAL DEVICES. CONSULT A PHYSICIAN OR THE MANUFACTURER OF THE MEDICAL DEVICE IF YOU HAVE ANY QUESTIONS. OTHER ELECTRONIC EQUIPMENT MAY ALSO BE SUBJECT TO INTERFERENCE.
- BEFORE MAKING ANY TEST CONNECTIONS, MAKE SURE YOU HAVE SWITCHED OFF ALL EQUIPMENT.

Cautions

- Servicing and alignment must be undertaken by qualified personnel only.
- Ensure all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.
- Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.
- Use only approved components as specified in the parts list.
- Ensure all components, modules, screws and insulators are correctly re-fitted after servicing and alignment. Ensure all cables and wires are repositioned correctly.

  Use only approved components as specified in the parts list.
- Never test a mobile phone WCDMA transmitter with full Tx power, if there is no possibility to perform the measurements in a good performance RF-shielded room. Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.
- During testing never activate the GSM or WCDMA transmitter without a proper antenna load, otherwise GSM or WCDMA PA may be damaged.

ESD protection

Nokia requires that service points have sufficient ESD protection (against static electricity) when servicing the phone.

Any product of which the covers are removed must be handled with ESD protection. The SIM card can be replaced without ESD protection if the product is otherwise ready for use.

To replace the covers ESD protection must be applied.

All electronic parts of the product are susceptible to ESD. Resistors, too, can be damaged by static electricity discharge.

All ESD sensitive parts must be packed in metallized protective bags during shipping and handling outside any ESD Protected Area (EPA).

Every repair action involving opening the product or handling the product components must be done under ESD protection.

ESD protected spare part packages MUST NOT be opened/closed out of an ESD Protected Area.

For more information and local requirements about ESD protection and ESD Protected Area, contact your local Nokia After Market Services representative.

Care and maintenance

This product is of superior design and craftsmanship and should be treated with care. The suggestions below will help you to fulfil any warranty obligations and to enjoy this product for many years.

- Keep the phone and all its parts and accessories out of the reach of small children.
- Keep the phone dry. Precipitation, humidity and all types of liquids or moisture can contain minerals that will corrode electronic circuits.
- Do not use or store the phone in dusty, dirty areas. Its moving parts can be damaged.
- Do not store the phone in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics.
- Do not store the phone in cold areas. When it warms up (to its normal temperature), moisture can form inside, which may damage electronic circuit boards.
- Do not drop, knock or shake the phone. Rough handling can break internal circuit boards.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the phone.
- Do not paint the phone. Paint can clog the moving parts and prevent proper operation.
- Use only the supplied or an approved replacement antenna. Unauthorised antennas, modifications or attachments could damage the phone and may violate regulations governing radio devices.

All of the above suggestions apply equally to the product, battery, charger or any accessory.

Company Policy

Our policy is of continuous development; details of all technical modifications will be included with service bulletins.

While every endeavour has been made to ensure the accuracy of this document, some errors may exist. If any errors are found by the reader, NOKIA MOBILE PHONES Business Group should be notified in writing/e-mail.

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Please send to:

NOKIA CORPORATION

Nokia Mobile Phones Business Group

Nokia Customer Care

PO Box 86

FIN-24101 SALO

Finland

E-mail: Service.Manuals@nokia.com

Battery information

Note: A new battery's full performance is achieved only after two or three complete charge and discharge cycles!

The battery can be charged and discharged hundreds of times but it will eventually wear out. When the operating time (talk-time and standby time) is noticeably shorter than normal, it is time to buy a new battery.

Use only batteries approved by the phone manufacturer and recharge the battery only with the chargers approved by the manufacturer. Unplug the charger when not in use. Do not leave the battery connected to a charger for longer than a week, since overcharging may shorten its lifetime. If left unused a fully charged battery will discharge itself over time.

Temperature extremes can affect the ability of your battery to charge.

For good operation times with Ni-Cd/NiMh batteries, discharge the battery from time to time by leaving the product switched on until it turns itself off (or by using the battery discharge facility of any approved accessory available for the product). Do not attempt to discharge the battery by any other means.

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

Do not short-circuit the battery. Accidental short-circuiting can occur when a metallic object (coin, clip or pen) causes direct connection of the + and - terminals of the battery (metal strips on the battery) for example when you carry a spare battery in your pocket or purse. Short-circuiting the terminals may damage the battery or the connecting object.

Leaving the battery in hot or cold places, such as in a closed car in summer or winter conditions, will reduce the capacity and lifetime of the battery. Always try to keep the battery between 15°C and 25°C (59°F and 77°F). A phone with a hot or cold battery may temporarily not work, even when the battery is fully charged. Batteries' performance is particularly limited in temperatures well below freezing.

Do not dispose of batteries in a fire!

Dispose of batteries according to local regulations (e.g. recycling). Do not dispose as household waste.

Nokia 6681/6682 Service Manual Structure

1 General Information
2 Parts Lists and Component Layouts
3 Service Software Instructions
4 Service Tools and Service Concepts
5 Disassembly/Reassembly Instructions
6 BB Troubleshooting and Manual Tuning Guide
7 RF Troubleshooting and Manual Tuning Guide
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1 — General Information

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RM-57/58 product selection

Nokia RM-57 is a tripleband handportable phone, supporting EGSM900/1800/1900 bands (RM-58: GSM850/1800/1900).

According to GSM standard 05.05 it responds to class 4 (max. 2W) in EGSM900 (RM-58: GSM850 Power class 4 (2W)), class 1 (1W) in GSM 1800 and class 1 in GSM 1900. The device supports EGPRS (EDGE) class B as well as Bluetooth 1.2 standard. The handset has a full phase 2 Type Approval and it complies with the GSM Type Approval. It also has a full CE approval and FCC approval.

The device is an MMS (Multimedia Messaging Service) enabled phone with a large bright color display and an integrated 1.3 megapixel (effective image size 1.23 megapixel) camera.

The MMS implementation follows the OMA MMS standard release 1.2.

WAP 2.0 compatible browser supports XHTML Mobile Profile (MP) and uses a TCP/IP stack to communicate with a gateway in network.

The operating system is Symbian 8.0a, also supporting MIDP Java 2.0 & CLDC1.1, which provides a good platform for 3rd party applications.

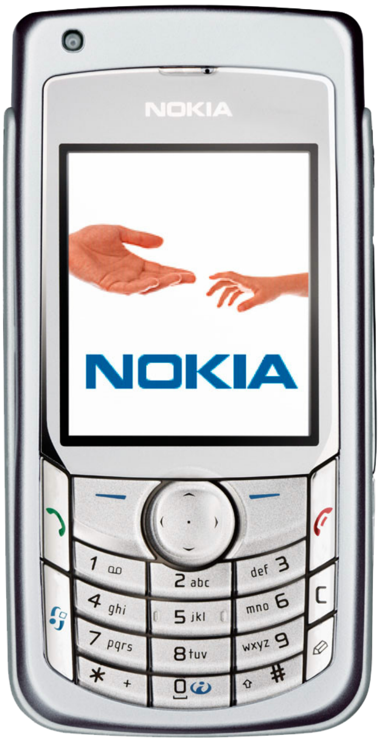

Figure 1 View of RM-57

Product features and sales package

Imaging

- Integrated 1.3 (effective 1.23) megapixel camera (1280 x 960 pixels) with smooth 6 x digital zoom and camera activation and control slide
- Integrated Flash LED
- Active TFT colour display, 176 x 208 pixels, 262k colours
- 10 MB on-board user memory Hot swap reduced size memory card slot
- Camcorder, still imaging and video call
- Video and still image editors

- Image and video upload to the web
- USB printing (Pictbridge)

Bearers and transport

- GSM triband phone (RM-57: EGSM900/1800/1900, RM-58: GSM850/1800/1900) EGPRS (class B, Multislot class 10) (Max DL=236.8 kbps UL=118.4 kbps)

Software platform

- SW platform: Nokia Series 60 rel 2.6

Connectivity

- Bluetooth (Headset & Handsfree profiles, BIP, GOP)
- RS (Half Size) MMC Card 64 MB
- Pop-Port™ interface with USB
- PC Suite connectivity with USB & Bluetooth

Productivity

- SMS, MMS and email
- MS Word, PowerPoint and Excel viewers
- PIM (Calendar & Contacts)
- Internet browser
- Video streaming (3GPP)
- Push to Talk
- Logs (last calls , timers and history list)
- Instant messaging
- Java™ MIDP 2.0, CLDC 1.13D API, PIM API, File access API
- MP3
- Data Transfer
- Settings Wizard/Access Point Configurator

Sales package

- Transceiver RM-57/58
- BL-5C Li-ion Battery
- ACP-12x Charger
- All-in-one User Guide (warranty card + accessory info + getting started sheet + invitational module for Club Nokia)
- CD-ROM (with PC-Suite and User Guide)
- Stereo Headset HDS-3 (APAC & Latin America: HS-3, China HS-27R)
- USB Cable DKU-2
- RS-MMC 64 MB with adapter
- MMC/SD card reader (EMEA)
- Wrist strap

Product and module list

Module name	Type code	Notes
System/RF Module	1LF	Main PWB with components

Module name	Type code	Notes
UI Module	1HV	Keyboard PWB with components. Part of the UI Frame Assy
Camera Module		Mirage-1.3X
Display Module		
Chassis Assy		Mechanical Assembly
UI Frame Assy		Mechanical Assembly
SW Module		

Mobile enhancements

Table 1 Audio

Enhancement	Type
Boom mono headset	HDB-4
Stereo headset	HDS-3
Mono headset	HS-5
Fashion stereo headset	HS-3
Wireless clip-on headset	HS-21W
Wireless boom headset	HS-4W
Wireless headset	HDW-3
Wireless headset	HS-11W
Wireless image headset	HS-13W
Inductive loopset	LPS-4
FM radio headset	HS-27R
Music stand	MD-1
Audio adapter	AD-15
TTY adapter	HDA-10

Table 2 Car

Enhancement	Type
Mobile charger	LCH-12
Wireless car kit	CK-1W
Advanced car kit	CK-7W
Plug-in car handsfree	HF-3
Headrest handsfree	BHF-3
Car kit	CK-10
Mobile holder	CR-27

Table 3 Carrying

Enhancement	Type
Carrying case	CNT-676

Table 4 Data

Enhancement	Type
USB data cable	DKU-2
RS multimedia card 64 MB	MU-1
RS multimedia card 128 MB	MU-2
Wireless GPS module	LD-1W

Table 5 Imaging

Enhancement	Type
Image album	PD-1
Remote camera	PT-6

Table 6 Messaging

Enhancement	Type
Nokia digital pen	SU-1B
Wireless keyboard	SU-8W

Table 7 Power

Enhancement	Type
Battery 900mAh Li-ion	BL-5C
Travel charger	ACP-12
Retractable charger	AC-1

Technical specifications

Transceiver general specifications

Unit	Dimensions (L x W x T)	Weight (g)	Volume (cm^3)
Transceiver with BL-5C 900mAh li-ion battery back	108.4 x 55.2 x 20.5	133 (including BL-5C battery)	104

Main RF characteristics for triple-band (EGSM900/1800/1900 and GSM850/1800/1900) phones

Parameter	Unit
Cellular systems	EGSM900, GSM1800/1900 and GSM850/1800/1900

Parameter	Unit
Rx frequency band	GSM850: 869 - 894
	EGSM900: 925 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
Tx frequency band	GSM850: 824 - 849 MHz
	EGSM900: 880 - 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
Output power	GSM850: +5...+33 dBm/3.2 mW...2W
	EGSM900: +5 ... +33dBm/3.2mW ... 2W
	GSM1800: +0 ... +30dBm/1.0mW ... 1W
	GSM1900: +0 ... +30dBm/1.0mW ... 1W
Number of RF channels	GSM850: 124
	EGSM900: 125
	GSM1800: 375
	GSM1900: 300
Channel spacing	200 kHz
Number of Tx power levels	GSM850, EGSM900: 15
	GSM1800, GSM1900: 16

Battery endurance

Battery	Capacity (mAh)	Talk time	Stand-by
BL-5C	900	up to 3-6 hrs*	up to 6 - 11 days*

Note: *Depends on the operator network configuration used.

Charging times

ACP-12	LCH-12
1h 15min	1h 15min

Environmental conditions

Environmental condition	Ambient temperature	Notes
Normal operation	-15ºC...+55ºC	Specifications fulfilled
Reduced performance	-25ºC...-15ºC +55ºC...+70ºC	Operational for shorts periods only

Environmental condition	Ambient temperature	Notes
Intermittent operation	-40ºC...-15ºC +70ºC...+85 ºC	Operation not guaranteed but an attempt to operate does not damage the phone.
No operation or storage	<-40ºC...>+85ºC	No storage or operation: an attempt may damage the phone.
Charging allowed	-25ºC...+50ºC	
Long term storage conditions	0ºC...+85ºC	

2 — Parts Lists and Component Layouts

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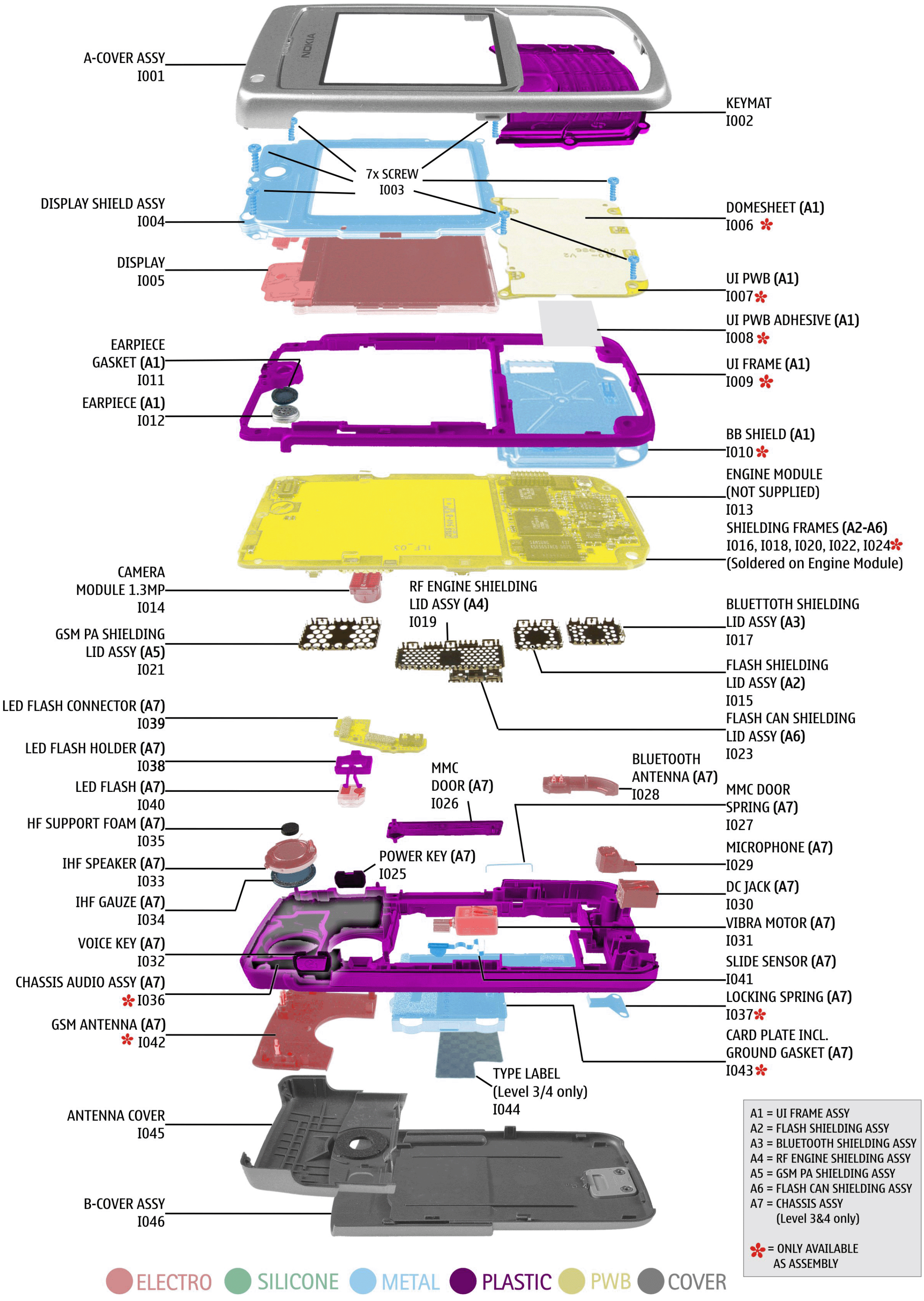
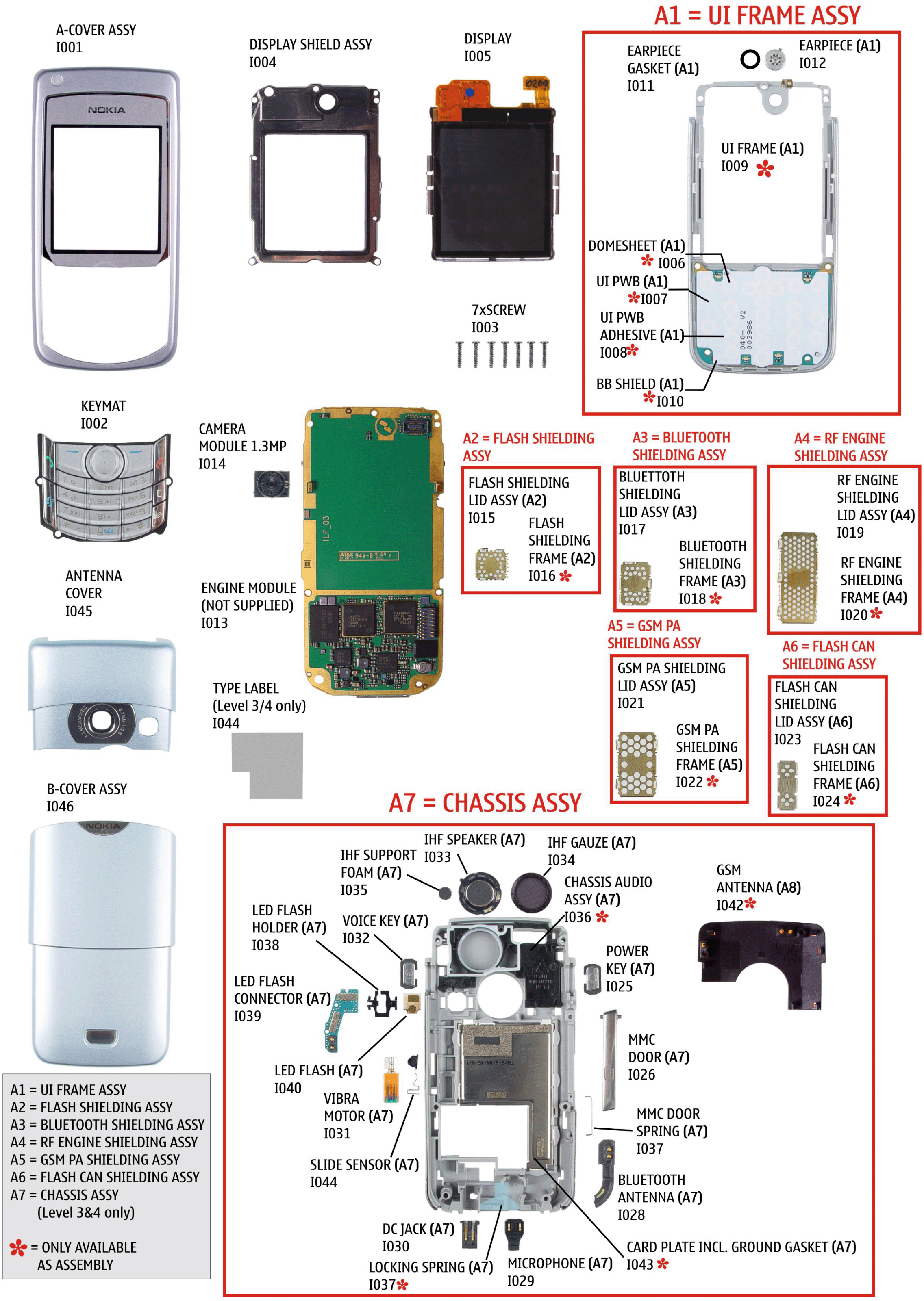
RM-57/58 exploded view


A-COVER ASSY
I001
KEYMAT
I002
7x SCREW
I003
DISPLAY SHIELD ASSY
I004
DOMESHEET (A1)
I006 ✽
DISPLAY
I005
UI PWB (A1)
I007 ✽
UI PWB ADHESIVE (A1)
I008 ✽
EARPIECE
GASKET (A1)
I011
UI FRAME (A1)
I009 ✽
EARPIECE (A1)
I012
BB SHIELD (A1)
I010 ✽
ENGINE MODULE
(NOT SUPPLIED)
I013
SHIELDING FRAMES (A2-A6)
I016, I018, I020, I022, I024 ✽
(Soldered on Engine Module)
CAMERA
MODULE 1.3MP
I014
RF ENGINE SHIELDING
LID ASSY (A4)
I019
BLUETOOTH SHIELDING
LID ASSY (A3)
I017
GSM PA SHIELDING
LID ASSY (A5)
I021
FLASH SHIELDING
LID ASSY (A2)
I015
LED FLASH CONNECTOR (A7)
I039
FLASH CAN SHIELDING
LID ASSY (A6)
I023
LED FLASH HOLDER (A7)
I038
MMC
DOOR (A7)
I026
BLUETOOTH
ANTENNA (A7)
I028
LED FLASH (A7)
I040
MMC DOOR
SPRING (A7)
I027
HF SUPPORT FOAM (A7)
I035
MICROPHONE (A7)
I029
IHF SPEAKER (A7)
I033
POWER KEY (A7)
I025
DC JACK (A7)
I030
IHF GAUZE (A7)
I034
VIBRA MOTOR (A7)
I031
VOICE KEY (A7)
I032
SLIDE SENSOR (A7)
I041
CHASSIS AUDIO ASSY (A7)
✽ I036
LOCKING SPRING (A7)
I037 ✽
GSM ANTENNA (A7)
✽ I042
CARD PLATE INCL.
GROUND GASKET (A7)
I043 ✽
TYPE LABEL
(Level 3/4 only)
I044
ANTENNA COVER
I045
B-COVER ASSY
I046
● ELECTRO ● SILICONE ● METAL ● PLASTIC ● PWB ● COVER

A1 = UI FRAME ASSY
A2 = FLASH SHIELDING ASSY
A3 = BLUETOOTH SHIELDING ASSY
A4 = RF ENGINE SHIELDING ASSY
A5 = GSM PA SHIELDING ASSY
A6 = FLASH CAN SHIELDING ASSY
A7 = CHASSIS ASSY
(Level 3&4 only)

✽ = ONLY AVAILABLE
AS ASSEMBLY

Spare parts overview


A-COVER ASSY
I001
DISPLAY SHIELD ASSY
I004
DISPLAY
I005
A1 = UI FRAME ASSY
EARPIECE GASKET (A1)
I011
EARPIECE (A1)
I012
UI FRAME (A1)
I009 ✻
DOMESHEET (A1)
✻ I006
UI PWB (A1)
✻I007
UI PWB ADHESIVE (A1)
I008✻
BB SHIELD (A1)
✻I010
7xSCREW
I003
KEYMAT
I002
CAMERA MODULE 1.3MP
I014
ENGINE MODULE (NOT SUPPLIED)
I013
ANTENNA COVER
I045
TYPE LABEL (Level 3/4 only)
I044
B-COVER ASSY
I046
A2 = FLASH SHIELDING ASSY
FLASH SHIELDING LID ASSY (A2)
I015
FLASH SHIELDING FRAME (A2)
I016 ✻
A3 = BLUETOOTH SHIELDING ASSY
BLUETTOTH SHIELDING LID ASSY (A3)
I017
BLUETOOTH SHIELDING FRAME (A3)
I018 ✻
A4 = RF ENGINE SHIELDING ASSY
RF ENGINE SHIELDING LID ASSY (A4)
I019
RF ENGINE SHIELDING FRAME (A4)
I020 ✻
A5 = GSM PA SHIELDING ASSY
GSM PA SHIELDING LID ASSY (A5)
I021
GSM PA SHIELDING FRAME (A5)
I022 ✻
A6 = FLASH CAN SHIELDING ASSY
FLASH CAN SHIELDING LID ASSY (A6)
I023
FLASH CAN SHIELDING FRAME (A6)
I024 ✻
A7 = CHASSIS ASSY
IHF SPEAKER (A7)
I033
IHF GAUZE (A7)
I034
IHF SUPPORT FOAM (A7)
I035
CHASSIS AUDIO ASSY (A7)
I036 ✻
GSM ANTENNA (A8)
I042✻
LED FLASH HOLDER (A7)
I038
VOICE KEY (A7)
I032
POWER KEY (A7)
I025
LED FLASH CONNECTOR (A7)
I039
MMC DOOR (A7)
I026
LED FLASH (A7)
I040
VIBRA MOTOR (A7)
I031
MMC DOOR SPRING (A7)
I037
SLIDE SENSOR (A7)
I044
BLUETOOTH ANTENNA (A7)
I028
DC JACK (A7)
I030
LOCKING SPRING (A7)
I037✻
MICROPHONE (A7)
I029
CARD PLATE INCL. GROUND GASKET (A7)
I043 ✻

A1 = UI FRAME ASSY
A2 = FLASH SHIELDING ASSY
A3 = BLUETOOTH SHIELDING ASSY
A4 = RF ENGINE SHIELDING ASSY
A5 = GSM PA SHIELDING ASSY
A6 = FLASH CAN SHIELDING ASSY
A7 = CHASSIS ASSY
(Level 3&4 only)

✻ = ONLY AVAILABLE AS ASSEMBLY

Parts lists

Mechanical spare parts list

- Bold = assembly (assy)
- I0xx = ITEM codes for upper or mono block
- I1xx = ITEM codes for hinge block
- I2xx = ITEM codes for lower block
- I3xx = ITEM codes for soldered spare parts in the upper hinge or lower block and not exchangeable

Note: For Nokia product codes, please refer to the latest Service Bulletins on the Partner Website (PWS). To ensure you are always using the latest codes, please check the PWS on a daily basis.

GSM antenna I042 has the same item reference in RM-57 and RM-58 but different product codes. See Variant parts for RM-58 (Page 2–38)

ITEM/ CIRCUIT REF.	QTY	PART NAME
I001	1	A-COVER ASSY
I002	1	KEYMAT
I003	7	SCREW M1.8X9
I004	1	DISPLAY SHIELD ASSY
I005	1	DISPLAY
	1	**UI FRAME ASSY (I006-I012)**
I006	1	DOMESHEET
I007	1	UI PWB
I008	1	UI PWB ADHESIVE
I009	1	UI FRAME
I010	1	BB SHIELD
I011	1	EARPIECE GASKET
I012	1	EARPIECE
I013	1	ENGINE MODULE
I014	1	CAMERA MODULE 1.3 MP
	1	**FLASH SHIELDING ASSY**
I015	1	FLASH SHIELDING LID ASSY
I016	1	FLASH SHIELDING FRAME
	1	**BLUETOOTH SHIELDING ASSY**
I017	1	BLUETOOTH SHIELDING LID ASSY
I018	1	BLUETOOTH SHIELDING FRAME
	1	**RF ENGINE SHIELDING ASSY**
I019	1	RF ENGINE SHIELDING LID ASSY

ITEM/ CIRCUIT REF.	QTY	PART NAME
I020	1	RF ENGINE SHIELDING FRAME
	1	**GSM PA SHIELDING ASSY**
I021	1	GSM PA SHIELDING LID ASSY
I022	1	GSM PA SHIELDING FRAME
	1	**FLASH CAN SHIELDING ASSY**
I023	1	FLASH CAN SHIELDING LID ASSY
I024	1	FLASH CAN SHIELDING FRAME
	1	**CHASSIS ASSY (I025-I044)**
I025	1	POWER KEY
I026	1	MMC DOOR
I027	1	MMC DOOR SPRING
I028	1	BLUETOOTH ANTENNA
I029	1	MICROPHONE
I030	1	DC JACK
I031	1	VIBRA MOTOR
I032	1	VOICE KEY
I033	1	IHF SPEAKER
I034	1	IHF GAUZE
I035	1	IHF SUPPORT FOAM
I036	1	CHASSIS AUDIO ASSY
I037	1	LOCKING SPRING
I038	1	LED FLASH HOLDER
I039	1	LED FLASH CONNECTOR
I040	1	LED FLASH
I041	1	SLIDE SENSOR
I042	1	GSM ANTENNA
I043	1	CARD PLATE INCL. GROUND GASKET
I044	1	TYPE LABEL
I045	1	ANTENNA -COVER
I046	1	B-COVER ASSY

RM-57 component parts list (1LF_09a)

Note: Antenna switch Z7503 and SAW filter Z7504 have the same reference in RM-57 and RM-58 but different product codes. See Variant parts (Page 2–38).

For Nokia product codes, please refer to the latest Service Bulletins on the Partner Website (PWS). To ensure you are always using the latest codes, please check the PWS on a daily basis.

BTM = Bottom

Item	Side	Grid reference		Description and Value			Type
A1470	BTM	~I	10	FLASH CAN ASSEMBLY 040-003354	~	~	SHIELD_040_003354
A3000	BTM	~C	7	FLASH CAN DMC07004 RM-1	~	~	SHIELD_DMC07004
A6000	BTM	~C	4	BT CAN DMC07003 RM-1	~	~	SHIELD_DMC07003
A7000	BTM	~F	12	RF ENGINE CAN DMC07006 RM-1	~	~	SHIELD_DMC07006
A7001	BTM	~I	15	WDCMA PA CAN DMC07007 RM-1	~	~	SHIELD_DMC07007
A7002	BTM	~C	18	GSM PA CAN DMC07005 RM-1	~	~	SHIELD_DMC07005
A7003	BTM	~I	13	VCO CAN DMD11427 RM-1	~	~	SHIELD_DMD11427
B2200	Top	~D	3	CRYSTAL 32.768KHZ +-20PPM 12.5PF	32.768kHz	~	CRYSTAL_3.3X1.6NR
C1470	BTM	~F	18	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C1471	BTM	~F	15	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C1472	BTM	~D	8	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C

Item	Side	Grid reference		Description and Value			Type
C1473	BTM	~D	8	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C1483	Top	~J	3	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C1484	BTM	~H	10	CHIPCAP X5R 4U7 K 6V3 0805	4u7	6V3	0805C
C1485	BTM	~H	11	CHIPCAP 2U2 K 25V 1206	2u2	25V	1206C_H1.8
C1486	BTM	~I	11	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C1487	BTM	~K	11	Chipcap 5% NP0	10p	50V	0402C
C1488	BTM	~J	11	Chipcap 5% NP0	10p	50V	0402C
C2000	BTM	~J	4	Chipcap 5% NP0	27p	50V	0402C
C2002	BTM	~E	3	CHIPCAP X5R 2U2 K 6V3 0603	2u2	6V3	0603C
C2003	Top	~E	2	CERCAP X7R 22N K 16V 0402	22n	16V	0402C
C2004	Top	~D	2	CERCAP X7R 22N K 16V 0402	22n	16V	0402C
C2005	Top	~E	2	Chipcap X7R 10% 16V 0402	10n	16V	0402C
C2006	Top	~E	2	Chipcap X7R 10% 16V 0402	10n	16V	0402C
C2007	Top	~D	2	Chipcap X7R 10% 16V 0402	10n	16V	0402C
C2008	Top	~D	2	Chipcap X7R 10% 16V 0402	10n	16V	0402C

Item	Side	Grid reference		Description and Value			Type
C2009	Top	~D	2	Chipcap X7R 10% 16V 0402	10n	16V	0402C
C2010	Top	~D	1	Chipcap X7R 10% 16V 0402	10n	16V	0402C
C2011	BTM	~F	3	CHIPCAP NP0 270P J 25V 0402	270p	25V	0402C
C2012	BTM	~J	3	CHIPCAP X5R 1U K 25V 0603	1u0	25V	0603C
C2070	BTM	~G	2	Chipcap 5% NP0	15p	50V	0402C
C2071	BTM	~I	3	CHIPTCAP 100U M 14V 6X3.2X2	100u_14V	14V	TANT_6.3X3.5_H2.0
C2072	BTM	~I	3	Chipcap 5% NP0	15p	50V	0402C
C2100	Top	~E	2	CHIPCAP X7R 15N K 16V 0402	15n	16V	0402C
C2101	Top	~E	2	CHIPCAP X7R 15N K 16V 0402	15n	16V	0402C
C2102	Top	~E	2	CHIPCAP X5R 2U2 K 6V3 0603	2u2	6V3	0603C
C2103	Top	~D	2	Chipcap 5% X7R	1n0	50V	0402C
C2104	Top	~D	2	Chipcap 5% X7R	1n0	50V	0402C
C2105	Top	~F	2	Chipcap X7R 10% 50V 0402	1n0	50V	0402C
C2106	Top	~F	2	Chipcap X7R 10% 50V 0402	1n0	50V	0402C
C2107	Top	~G	2	Chipcap X7R 10% 50V 0402	1n0	50V	0402C

Item	Side	Grid reference		Description and Value			Type
C2108	Top	~G	2	Chipcap X7R 10% 50V 0402	1n0	50V	0402C
C2109	Top	~G	2	Chipcap X7R 10% 50V 0402	1n0	50V	0402C
C2110	Top	~G	2	Chipcap X7R 10% 50V 0402	1n0	50V	0402C
C2200	Top	~E	2	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C2201	Top	~D	4	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C2202	Top	~D	3	Chipcap X7R 10% 50V 0402	1n0	50V	0402C
C2203	Top	~D	3	Chipcap X7R 10% 50V 0402	1n0	50V	0402C
C2204	Top	~D	3	Chipcap X7R 10% 50V 0402	1n0	50V	0402C
C2205	Top	~D	3	Chipcap X7R 10% 50V 0402	1n0	50V	0402C
C2206	Top	~D	3	Chipcap X7R 10% 50V 0402	1n0	50V	0402C
C2207	Top	~D	4	Chipcap X7R 10% 50V 0402	1n0	50V	0402C
C2208	Top	~D	4	Chipcap 5% NP0	27p	50V	0402C
C2209	Top	~D	4	Chipcap 5% NP0	22p	50V	0402C
C2210	Top	~F	4	CHIPCAP X5R 1U K 16V 0603	1u0	16V	0603C
C2211	Top	~G	3	CHIPCAP X5R 4U7 K 10V 0805	4u7	10V	0805C

Item	Side	Grid reference		Description and Value			Type
C2212	Top	~F	3	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C2213	Top	~D	5	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C2214	Top	~E	4	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C2215	Top	~F	4	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C2216	Top	~E	4	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C2217	Top	~D	5	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C2219	Top	~D	4	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C2220	Top	~F	4	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C2221	Top	~F	4	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C2222	Top	~F	4	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C2223	Top	~D	2	Chipcap X7R 10% 16V 0402	10n	16V	0402C
C2224	Top	~E	5	Chipcap X7R 10% 16V 0402	10n	16V	0402C
C2225	Top	~D	4	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C2226	Top	~F	3	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C

Item	Side	Grid reference		Description and Value			Type
C2227	Top	~F	4	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C2228	Top	~E	5	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C2230	Top	~E	5	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C2231	Top	~F	2	CHIPCAP X5R 10U M 6V3 0805	10U	6V3	0805C
C2232	Top	~F	4	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C2233	Top	~C	3	Chipcap 5% NP0	27p	50V	0402C
C2234	Top	~D	4	Chipcap 5% NP0	27p	50V	0402C
C2235	Top	~C	3	Chipcap X7R 10% 50V 0402	1n0	50V	0402C
C2237	Top	~E	4	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C2240	Top	~J	5	Chipcap 5% NP0	12p	50V	0402C
C2241	Top	~D	4	Chipcap 5% NP0	12p	50V	0402C
C2242	Top	~F	5	Chipcap 5% NP0	12p	50V	0402C
C2243	Top	~F	6	Chipcap 5% NP0	12p	50V	0402C
C2244	Top	~J	5	Chipcap 5% NP0	12p	50V	0402C
C2300	Top	~I	3	Chipcap X7R 10% 16V 0402	10n	16V	0402C
C2301	Top	~I	3	CHIPCAP X5R 22U M 6V3 0805	22u	6V3	0805C

Item	Side	Grid reference		Description and Value			Type
C2302	Top	~H	3	CHIPCAP X5R 22U M 6V3 0805	22u	6V3	0805C
C2303	Top	~H	5	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C2304	Top	~H	3	Chipcap X7R 10% 16V 0402	10n	16V	0402C
C2306	Top	~I	4	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C2307	Top	~I	4	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C2309	Top	~I	2	CHIPCAP X5R 22U M 6V3 0805	22u	6V3	0805C
C2312	Top	~I	5	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C2313	Top	~I	5	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C2314	Top	~I	2	CHIPCAP X5R 4U7 K 25V 0805	4u7	25V	0805C
C2315	Top	~G	2	CHIPCAP X5R 4U7 K 25V 0805	4u7	25V	0805C
C2316	Top	~H	3	Chipcap X7R 10% 50V 0402	1n0	50V	0402C
C2318	Top	~H	1	Chipcap 5% NP0	27p	50V	0402C
C2700	BTM	~K	7	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C2800	Top	~E	5	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C

Item	Side	Grid reference		Description and Value			Type
C2801	Top	~D	8	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C2802	Top	~C	6	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C2803	Top	~E	5	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C2804	Top	~C	5	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C2805	Top	~F	7	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C2806	Top	~D	8	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C2807	Top	~D	8	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C2808	Top	~E	8	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C2809	Top	~D	5	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C2810	Top	~F	7	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C2811	Top	~E	8	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C

Item	Side	Grid reference		Description and Value			Type
C2812	Top	~E	5	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C2813	Top	~D	5	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C2814	Top	~C	6	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C3000	BTM	~D	6	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C3001	BTM	~D	7	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C3002	BTM	~B	6	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C3003	BTM	~B	7	Chipcap X7R 10% 16V 0402	10n	16V	0402C
C3004	Top	~B	3	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C3005	Top	~C	5	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C3006	Top	~D	4	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C3007	Top	~C	3	Chipcap X7R 10% 16V 0402	10n	16V	0402C

Item	Side	Grid reference		Description and Value			Type
C3008	Top	~D	4	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C4200	Top	~G	4	CHIPCAP X5R 22U M 6V3 0805	22u	6V3	0805C
C4201	Top	~G	5	CHIPCAP X5R 22U M 6V3 0805	22u	6V3	0805C
C4202	Top	~G	4	Chipcap X7R 10% 16V 0402	10n	16V	0402C
C4400	Top	~B	21	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C4401	Top	~C	21	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C4402	Top	~B	19	Chipcap 5% NP0	27p	50V	0402C
C4403	BTM	~J	11	Chipcap X7R 10% 50V 0402	1n0	50V	0402C
C4800	Top	~I	6	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C4801	Top	~G	5	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C4802	Top	~H	5	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C4803	Top	~F	6	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C4804	Top	~I	7	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C

Item	Side	Grid reference		Description and Value			Type
C4805	Top	~G	8	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C4806	Top	~F	8	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C4807	Top	~H	5	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C4808	Top	~H	5	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C4809	Top	~G	8	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C4810	Top	~I	7	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C4811	Top	~F	6	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C4812	Top	~G	5	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C4813	Top	~F	6	Chipcap X7R 10% 50V 0402	1n0	50V	0402C
C4814	Top	~H	8	Chipcap 5% NP0	22p	50V	0402C
C5000	Top	~K	5	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C5001	Top	~H	5	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C

Item	Side	Grid reference		Description and Value			Type
C5002	Top	~J	8	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C5003	Top	~I	6	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C5004	Top	~I	5	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C5005	Top	~I	5	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C5006	Top	~J	5	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C5200	BTM	~C	8	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C6031	BTM	~B	4	Chipcap X7R 10% 16V 0402	10n	16V	0402C
C6033	BTM	~D	3	Chipcap X7R 10% 16V 0402	10n	16V	0402C
C6035	BTM	~D	4	Chipcap X7R 10% 16V 0402	10n	16V	0402C
C6036	BTM	~C	3	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C6042	BTM	~C	3	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C6043	BTM	~B	3	Chipcap X7R 10% 16V 0402	10n	16V	0402C
C6044	BTM	~C	5	Chipcap 5% NP0	18p	50V	0402C
C6045	BTM	~D	4	Chipcap 5% NP0	15p	50V	0402C

Item	Side	Grid reference		Description and Value			Type
C6046	BTM	~C	4	CHIPCAP NP0 1P2 B 50V 0402	1p2	50V	0402C
C6047	BTM	~B	3	CHIPCAP X5R 2U2 K 6V3 0603	2u2	6V3	0603C
C7501	BTM	~G	14	Chipcap 5% NP0	18p	50V	0402C
C7503	BTM	~G	13	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C7504	BTM	~G	13	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C7505	BTM	~G	12	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C
C7507	BTM	~F	13	Chipcap 5% NP0	18p	50V	0402C
C7508	BTM	~F	13	Chipcap 5% NP0	18p	50V	0402C
C7509	BTM	~F	13	Chipcap +-0.25pF NP0	2p7	50V	0402C
C7512	BTM	~D	19	Chipcap +-0.25pF NP0	2p7	50V	0402C
C7513	BTM	~F	12	Chipcap X7R 10% 25V 0402	4n7	25V	0402C
C7514	BTM	~D	19	Chipcap +-0.25pF NP0	2p7	50V	0402C
C7515	BTM	~G	11	Chipcap 5% NP0	10p	50V	0402C
C7516	BTM	~E	11	CHIPCAP NP0 180P J 25V 0402	180p	25V	0402C
C7518	BTM	~G	14	CHIPCAP X5R 100N M 16V 0402	100n	16V	0402C

Item	Side	Grid reference		Description and Value			Type
C7520	BTM	~G	14	Chipcap 5% NP0	18p	50V	0402C
C7522	BTM	~E	12	CHIPCAP NP0 180P J 25V 0402	180p	25V	0402C
C7523	BTM	~D	18	Chipcap +-0.25pF NP0	5p6	50V	0402C
C7524	BTM	~E	11	CHIPCAP NP0 2N7 G 50V 0603	2n7	50V	0603C
C7525	BTM	~D	18	Chipcap +-0.25pF NP0	5p6	50V	0402C
C7527	BTM	~F	13	Chipcap 5% NP0	100p	50V	0402C
C7528	BTM	~F	13	Chipcap 5% NP0	22p	50V	0402C
C7529	BTM	~G	12	Chipcap 5% NP0	100p	50V	0402C
C7530	BTM	~G	12	Chipcap X7R 10% 16V 0402	8n2	16V	0402C
C7531	BTM	~F	13	Chipcap 5% NP0	22p	50V	0402C
C7532	BTM	~G	12	Chipcap X7R 10% 16V 0402	8n2	16V	0402C
C7533	BTM	~G	11	Chipcap X7R 10% 16V 0402	10n	16V	0402C
C7534	BTM	~G	13	Chipcap X7R 10% 16V 0402	8n2	16V	0402C
C7535	BTM	~F	12	Chipcap 5% NP0	100p	50V	0402C
C7536	BTM	~G	13	Chipcap X7R 10% 16V 0402	8n2	16V	0402C
C7541	BTM	~G	11	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C

Item	Side	Grid reference		Description and Value			Type
C7543	BTM	~G	11	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C7545	BTM	~B	17	Chipcap +-0.25pF NP0	4p7	50V	0402C
C7547	BTM	~G	10	Chipcap +-0.25pF NP0	1p8	50V	0402C
C7548	BTM	~G	10	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V	0603C
C7549	BTM	~F	11	Chipcap 5% NP0	100p	50V	0402C
C7550	BTM	~G	9	Chipcap +-0.25pF NP0	2p7	50V	0402C
C7552	BTM	~G	9	Chipcap +-0.25pF NP0	2p7	50V	0402C
C7553	BTM	~G	9	Chipcap X7R 10% 16V 0402	8n2	16V	0402C
C7554	BTM	~J	13	Chipcap +-0.25pF NP0	4p7	50V	0402C
C7555	BTM	~J	13	CHIPCAP NP0 0P5 C 50V 0402	0p5	50V	0402C
C7556	BTM	~D	17	Chipcap 5% NP0	10p	50V	0402C
C7558	BTM	~F	10	Chipcap X7R 10% 50V 0402	1n0	50V	0402C
C7559	BTM	~B	18	Chipcap +-0.25pF NP0	1p0	50V	0402C
C7560	BTM	~G	9	Chipcap X7R 10% 25V 0402	4n7	25V	0402C
C7561	BTM	~D	17	Chipcap +-0.25pF NP0	4p7	50V	0402C

Item	Side	Grid reference		Description and Value			Type
C7563	BTM	~D	17	Chipcap +-0.25pF NP0	4p7	50V	0402C
C7564	BTM	~C	18	Chipcap X7R 10% 50V 0402	1n0	50V	0402C
C7567	BTM	~F	10	Chipcap 5% NP0	15p	50V	0402C
C7568	BTM	~G	9	Chipcap 5% NP0	150p	50V	0402C
C7569	BTM	~D	18	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V	0603C
C7570	BTM	~F	9	Chipcap 5% NP0	18p	50V	0402C
C7571	BTM	~J	12	CHIPCAP NP0 330P J 50V 0402	330p	50V	0402C
C7573	BTM	~G	9	CHIPCAP NP0 2N2 G 16V 0603	2n2	16V	0603C
C7575	BTM	~F	10	Chipcap 5% NP0	15p	50V	0402C
C7577	BTM	~F	10	Chipcap 5% NP0	15p	50V	0402C
C7581	BTM	~D	19	Chipcap +-0.25pF NP0	5p6	50V	0402C
C7582	BTM	~G	9	Chipcap 5% NP0	100p	50V	0402C
C7584	BTM	~D	19	Chipcap +-0.25pF NP0	5p6	50V	0402C
C7593	BTM	~D	17	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V	0603C
C7596	BTM	~F	14	Chipcap +-0.25pF NP0	2p7	50V	0402C
C7597	BTM	~D	15	CHIPTCAP 100U M 14V 6X3.2X2	100u_14V	14V	TANT_6.3X 3.5_H2.0

Item	Side	Grid reference		Description and Value			Type
C7598	BTM	~G	11	CHIPCAP NPO 0P5 C 50V 0402	0p5	50V	0402C
C7599	BTM	~D	16	Chipcap 5% NPO	10p	50V	0402C
D2800	Top	~D	7	RAP3G V2.11 UMC8D F761800B C27 BGA289	~	~	uBGA_289
D3000	BTM	~C	7	FLASH 4MX16 1.8/ 1.8V FBGA44	4Mx16	~	PBFREEBGA40_64MB_54MHZ_MAX
D3001	Top	~B	4	SDRAM 4MX16 1.8V/1.8V WBGA60 PBFREE	4Mx16	~	SDRAM_110MHZ_64MBIT_BGA60_PBFREE_MAX
D4800	Top	~G	6	HELEN3 PS1.1E F761991A C027 UBGA289	~	~	uBGA_289
D5000	Top	~J	6	COMBO 256M DDR + 256M NAND FBGA121 PBFREE	256M_DDR / 256M_NAND	~	FBGA121_H1.1
F2000	BTM	~J	3	SM FUSE F 2.0A 32V	2A	~	0603_FUSE_AVX2MATS
G2200	Top	~B	3	CELL CAPACITOR 0.01MAH 3V3	3V3	~	BATTER_RB414H
G7500	BTM	~F	11	VCO 3296-3980MHZ FOUR 2.7V 20MA	3296-3980MHz	~	VCO_FDK_IT_4
G7501	BTM	~G	12	VCTCXO 38.4MHZ 2.5V	38.4MHz	~	NKG3176B_H1.0

Item	Side	Grid reference		Description and Value			Type
G7502	BTM	~I	13	VCO 3296-3980MHZ FOUR 2.7V 20MA	3296-3980MHz	~	VCO_FDK_IT_4
L1473	BTM	~I	9	CHOKE 3.3UH 1.3A 3.7X3.5X1.2MM	3u3H	~	CHOKE_VLF4012AT
L1474	Top	~J	3	FERR.BEAD 0R03 42R/100MHZ 3A 0805	42R/100MHz	~	0805_BLM21
L1479	BTM	~K	12	CHIP COIL 27N J Q27/800M 0402	27nH	~	0402L
L1480	BTM	~J	12	CHIP COIL 27N J Q27/800M 0402	27nH	~	0402L
L2000	BTM	~J	3	FERR.BEAD 220R/100M 2A 0R05 0603	220R/100MHz	~	0603_BLM
L2001	Top	~F	2	CHIP BEAD ARRAY 2X1000R 0405	2x1000R/100MHz	~	0405_2_MATSU
L2002	BTM	~D	2	CHIP BEAD ARRAY 2X1000R 0405	2x1000R/100MHz	~	0405_2_MATSU
L2003	BTM	~D	2	CHIP BEAD ARRAY 2X1000R 0405	2x1000R/100MHz	~	0405_2_MATSU
L2100	Top	~G	20	CHIP BEAD ARRAY 2X1000R 0405	2x1000R/100MHz	~	0405_2_MATSU
L2101	Top	~F	2	FERR.BEAD 220R/100M 2A 0R05 0603	220R/100MHz	~	0603_BLM

Item	Side	Grid reference		Description and Value			Type
L2102	BTM	~E	19	CHIP COIL 56N J Q38/250MHZ 0603	56nH	~	COIL_0603 CS
L2103	BTM	~F	19	CHIP COIL 56N J Q38/250MHZ 0603	56nH	~	COIL_0603 CS
L2104	Top	~F	2	FERR.BEAD 220R/100M 2A 0R05 0603	220R/100MHz	~	0603_BLM
L2105	Top	~F	2	FERRITE BEAD 220R 0R45 0.3A 0402	220R/100MHz	~	0402L_XL
L2106	Top	~F	2	FERRITE BEAD 220R 0R45 0.3A 0402	220R/100MHz	~	0402L_XL
L2202	Top	~D	5	FERR.BEAD 220R/100M 2A 0R05 0603	220R/100MHz	~	0603_BLM
L2203	Top	~E	5	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/100MHz	~	FERRITE_0402
L2204	Top	~E	5	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/100MHz	~	FERRITE_0402
L2205	Top	~F	3	FERR.BEAD 220R/100M 2A 0R05 0603	220R/100MHz	~	0603_BLM
L2206	Top	~E	5	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/100MHz	~	FERRITE_0402

Item	Side	Grid reference		Description and Value			Type
L2301	Top	~I	3	FERR.BEAD 220R/100M 2A 0R05 0603	220R/100MHz	~	0603_BLM
L2302	Top	~H	3	CHOKE 10U 0.8A 0R24 4X4X1.8	10uH	~	CHOKE_SER400
L2304	Top	~H	2	CHOKE 22U M 1R4 0.33A 3.3X3.3X1.5	22uH	~	CHOKE_984FB
L4200	Top	~G	3	CHOKE 10U 0.8A 0R24 4X4X1.8	10uH	~	CHOKE_SER400
L4201	Top	~G	5	FERR.BEAD 220R/100M 2A 0R05 0603	220R/100MHz	~	0603_BLM
L4400	Top	~C	21	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/100MHz	~	FERRITE_0402
L4401	Top	~D	21	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/100MHz	~	FERRITE_0402
L5200	BTM	~C	9	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/100MHz	~	FERRITE_0402
L6031	BTM	~C	4	CHIP COIL 3N3 +-0N3 Q28/800M 0402	3n3H	~	0402L
L6032	BTM	~C	4	CHIP COIL 3N3 +-0N3 Q28/800M 0402	3n3H	~	0402L
L7502	BTM	~G	9	CHIP COIL 100N J Q16/300M 0402	100nH	~	0402L

Item	Side	Grid reference		Description and Value			Type
L7503	BTM	~G	11	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~	FERRITE_0402
L7504	BTM	~D	19	CHIP COIL 27N J Q27/ 800M 0402	27nH	~	0402L
L7505	BTM	~D	19	CHIP COIL 12N J Q31/ 800M 0402	12nH	~	0402L
L7506	BTM	~D	18	CHIP COIL 12N J Q31/ 800M 0402	12nH	~	0402L
L7516	BTM	~D	16	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~	FERRITE_0402
L7517	BTM	~G	10	CHIP COIL 1N5 +-0N3 Q33/800M 0402	1n5H	~	0402L
N1470	BTM	~C	8	REG LP3990YDX-1.5V LLP-6	~	1.5V	LLP6
N1471	BTM	~I	11	STEP-UP DC/DC CONV SON3024-8	~	~	SON3024_8
N2200	Top	~E	3	RETU 3.02 L TSA1GJWE TFBGA108	~	~	TFBGA_108
N2300	Top	~H	4	TAHVO V4.1 TFBGA84 6X6	~	~	TFBGA_84_6.15X6.15
N2301	Top	~G	2	WHITE LED DRIVER 4LEDS 500MW 8BUMP USMD8	~	~	USMD8_1.69X1.69

Item	Side	Grid reference		Description and Value			Type
N4200	Top	~G	4	DC_DC CONV LM2708H-1.40V/1.09V	~	~	USMD_10_2.458X1.899
N6030	BTM	~C	3	BC3-ROM WITH BC2 MOULD MATERIAL	~	~	TFBGA84_H1.0
N6031	BTM	~B	3	VREG 2.85/150MA LP3987-2.85 USMD5	~	2.85V	USMD5_1.468X1.036
N7500	BTM	~F	13	RF ASIC HINKU310A TFBGA84	~	~	TFBGA_84_6.15X6.15
N7501	BTM	~G	10	RF ASIC VINKU314A TFBGA64	~	~	TFBGA64_H1.2
N7502	BTM	~C	17	PW AMP RF9292E9.2 QUADBAND	~	~	RITSA_PA_REL3
R1470	Top	~F	8	Resistor 5% 63mW	100R	~	0402R
R1471	Top	~F	8	Resistor 5% 63mW	100R	~	0402R
R1472	Top	~H	8	Resistor 5% 63mW	3k3	~	0402R
R1473	Top	~H	8	Resistor 5% 63mW	3k3	~	0402R
R1474	Top	~F	7	Resistor 5% 63mW	33R	~	0402R
R1487	BTM	~I	10	CHIPRES 0W06 6R8 J 0402	6R8	~	0402R
R1489	BTM	~H	11	Resistor 5% 63mW	3k3	~	0402R
R2000	BTM	~E	3	Resistor 5% 63mW	220R	~	0402R

Item	Side	Grid reference		Description and Value			Type
R2001	Top	~E	2	ASIP MIC W/ESD RES +CAP+ZDI BGA11	~	~	uBGA11_2.15X1.65
R2002	Top	~E	2	Resistor 5% 63mW	10R	~	0402R
R2003	Top	~E	1	Resistor 5% 63mW	10R	~	0402R
R2004	Top	~D	2	Resistor 5% 63mW	10R	~	0402R
R2005	Top	~D	2	Resistor 5% 63mW	10R	~	0402R
R2006	BTM	~C	2	ASIP 4XESD **PB-FREE** BGA5	~	~	uBGA5
R2007	BTM	~F	2	ASIP SILIC USB OTG / ESD BGA11	~	~	uBGA11_1.6X2.1
R2009	BTM	~F	3	Resistor 5% 63mW	100R	~	0402R
R2010	Top	~H	4	Resistor 5% 63mW	220k	~	0402R
R2011	BTM	~F	3	Resistor 5% 63mW	120k	~	0402R
R2070	BTM	~G	2	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~	0402_VAR
R2071	Top	~B	3	NTC RES 47K J B=4050 +-3% 0402	47k	~	0402_NTH5
R2072	BTM	~G	2	Resistor 5% 63mW	100R	~	0402R
R2100	Top	~E	2	ASIP SINGLE ENDED MICROPHONE INTERF BGA8	~	~	FLIP_CHIP_8_1.7X1.7
R2101	Top	~E	2	Resistor 5% 63mW	220R	~	0402R

Item	Side	Grid reference		Description and Value			Type
R2104	Top	~F	19	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~	0402_VAR
R2105	Top	~G	19	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~	0402_VAR
R2106	BTM	~E	19	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~	0402_VAR
R2107	BTM	~E	19	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~	0402_VAR
R2200	Top	~D	2	Resistor 5% 63mW	100k	~	0402R
R2201	Top	~D	4	Resistor 5% 63mW	120k	~	0402R
R2205	Top	~D	4	CHIPRES 0W06 2M2 J 0402	2M2	~	0402R
R2301	Top	~G	2	Resistor 5% 63mW	4k7	~	0402R
R2302	Top	~G	2	Resistor 5% 63mW	10k	~	0402R
R2303	Top	~G	2	Resistor 5% 63mW	1k0	~	0402R
R2304	Top	~G	1	Resistor 5% 63mW	39R	~	0402R
R2305	Top	~H	5	Resistor 5% 63mW	33R	~	0402R
R2700	Top	~J	4	ASIP SIM INTERFACE **LOW CAP**BGA 8	~	~	uBGA8_1.4 7X1.47
R3000	BTM	~B	7	Resistor 5% 63mW	4k7	~	0402R

Item	Side	Grid reference		Description and Value			Type
R4400	Top	~D	2	Resistor 5% 63mW	470k	~	0402R
R4401	Top	~D	3	Resistor 5% 63mW	100k	~	0402R
R4402	Top	~D	2	Resistor 5% 63mW	470k	~	0402R
R4403	Top	~J	21	NTC RES 47K J B=4050 +-3% 0402	47k	~	0402_NTH5
R4404	BTM	~J	17	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~	0402_VAR
R4405	BTM	~J	17	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~	0402_VAR
R4406	BTM	~B	17	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~	0402_VAR
R4408	BTM	~K	11	Resistor 5% 63mW	10k	~	0402R
R4409	BTM	~K	11	Resistor 5% 63mW	1k0	~	0402R
R4410	BTM	~K	11	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~	0402_VAR
R4800	Top	~I	7	Resistor 5% 63mW	10R	~	0402R
R4809	Top	~F	5	Resistor 5% 63mW	1k0	~	0402R
R4810	Top	~H	8	Resistor 5% 63mW	15R	~	0402R
R5100	BTM	~E	8	Resistor 5% 63mW	10k	~	0402R

Item	Side	Grid reference		Description and Value			Type
R5200	BTM	~B	8	ASIP EMIF04-MMC02F2**PB-FREE**	~	~	uBGA11_1.62X2.12
R5204	BTM	~C	15	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~	0402_VAR
R6030	BTM	~D	4	Resistor 5% 63mW	10k	~	0402R
R6034	BTM	~B	3	CHIPRES 0W06 2R2 J 0402	2R2	~	0402R
R7501	BTM	~E	11	Resistor 5% 63mW	3k9	~	0402R
R7503	BTM	~F	9	Resistor 5% 63mW	4k7	~	0402R
R7504	BTM	~G	13	CHIPRES 0W06 10K F 0402	10k	~	0402R
R7505	BTM	~E	12	Chipres 0W06 6k8 F 0402	6k8	~	0402R
R7506	BTM	~D	18	Resistor 5% 63mW	33R	~	0402R
R7509	BTM	~G	11	Resistor 5% 63mW	22k	~	0402R
R7512	BTM	~D	16	RES NETWORK 0W04 2DB ATT 0404	436R/11R6/436R	~	0404_RAC10
R7514	BTM	~F	11	Resistor 5% 63mW	12k	~	0402R
R7516	BTM	~C	18	Resistor 5% 63mW	1k0	~	0402R
R7518	BTM	~B	17	Resistor 5% 63mW	470k	~	0402R
R7519	BTM	~G	10	Resistor 5% 63mW	1k0	~	0402R

Item	Side	Grid reference		Description and Value			Type
R7521	BTM	~F	10	CHIPRES 0W06 10K F 0402	10k	~	0402R
R7523	BTM	~G	9	CHIPRES 0W06 9K1 F 100PPM 0402	9k1	~	0402R
R7528	BTM	~G	10	Resistor 5% 63mW	470k	~	0402R
R7534	BTM	~B	18	Resistor 5% 63mW	470k	~	0402R
S4400	BTM	~K	18	SM TACT SW TRAV 0.2 4.1X3.55X1.75	~	~	SWITCH_SKRE_II
S4401	BTM	~A	18	SM TACT SW TRAV 0.2 4.1X3.55X1.75	~	~	SWITCH_SKRE_II
S5200	BTM	~B	15	SM SW DETECTOR SPST-NO 5V 1MA	~	~	SWITCH_SPVN220100
S5202	BTM	~K	11	SWITCH PB LIGHT TOUCH EVPAA002C	~	~	SWITCH_EVQ058Z4007
T7501	BTM	~F	12	TRANSF BALUN 3800 +-550MHZ 0805	~	~	TRANS_LDB15
T7502	BTM	~C	16	TRANSF BALUN 1800 +-100mhz 2x1.25	~	~	TRANS_LDB15
T7503	BTM	~H	13	TRANSF BALUN 3800 +-550MHZ 0805	~	~	TRANS_LDB15

Item	Side	Grid reference		Description and Value			Type
V1470	Top	~J	4	DIX2 FAST 1PS89SS05 80V CC SC89	~	~	SS_MINI_3_H0.8
V1471	BTM	~I	11	SCH DI PMEG3002 30V 500MA SOD882	~	~	DIODE_PMEG3002
V1472	BTM	~I	10	MOSFET N 20V 350MA SOT416	~	~	SC_75A_H0.95
V2000	BTM	~J	3	TVS DI 1PMT16AT3 16V 175W PWRMITE	~	~	CASE_457
V2300	Top	~H	5	TR DTC143ZEN RBE4K7/47K 0A1 SC75	~	~	EM3
V4400	Top	~J	21	DI PHOTO PT202MR0MP 620NM 1.25X2	~	~	PT202MR0MP
X1470	BTM	~F	16	CAMERA MOD.SOCKET 2X7POL SPR P1.4	~	~	SOCKET_DMD10413
X2001	BTM	~E	1	SM SYSTEM CONNECTOR 14POL	~	~	SYSCON_MQ202_NK_14R3
X2060	Top	~K	14	MODULE ID COMPONENT 2.8X1.8X0.3	~	~	TRACEABILITY_PAD
X2070	BTM	~H	3	SM LYNX BATT.CONN 3POL 12V 2A H7	~	~	LYNX_BATT_CONN
X2700	BTM	~H	6	SM SIM CONN 2X3POL P2.54 15V 0.5A	~	~	SIM_READER_M_C707_10M006_532_2

Item	Side	Grid reference		Description and Value			Type
X4400	Top	~B	6	SM CONN 16P SPR P1.3 50V PWB/PWB	~	~	SMK_4309_B_B_16P_V8
X4401	Top	~C	20	SM CONN 2X12F P0.4 30V 0.3A PCB/PCB	~	~	JST_R_JAVK_G_1_R3
X4402	Top	~K	16	GROUNDING SPRING DMD12054 RM-1	~	~	GND_SPRING_DMD12054
X4403	Top	~B	16	GROUNDING SPRING DMD12054 RM-1	~	~	GND_SPRING_DMD12054
X5200	BTM	~C	12	CONN SMC RS-MMC 6POL P2.5	~	~	MOLEX_MMC_P03_3D0545_001
Z2000	BTM	~F	2	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/100MHz	~	FERRITE_0402
Z2001	BTM	~F	2	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/100MHz	~	FERRITE_0402
Z2003	BTM	~G	2	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/100MHz	~	FERRITE_0402
Z4400	Top	~B	8	ASIP 10-CH ESD EMI FILTER BGA25	~	~	uBGA25_2.69X2.69
Z4401	Top	~B	7	ASIP 2-CH MIC EMI/ESD **PB-FREE**	~	~	FC6_1.65X1.15
Z4402	Top	~I	8	ASIP 10-CH ESD EMI FILTER BGA25	~	~	uBGA25_2.69X2.69

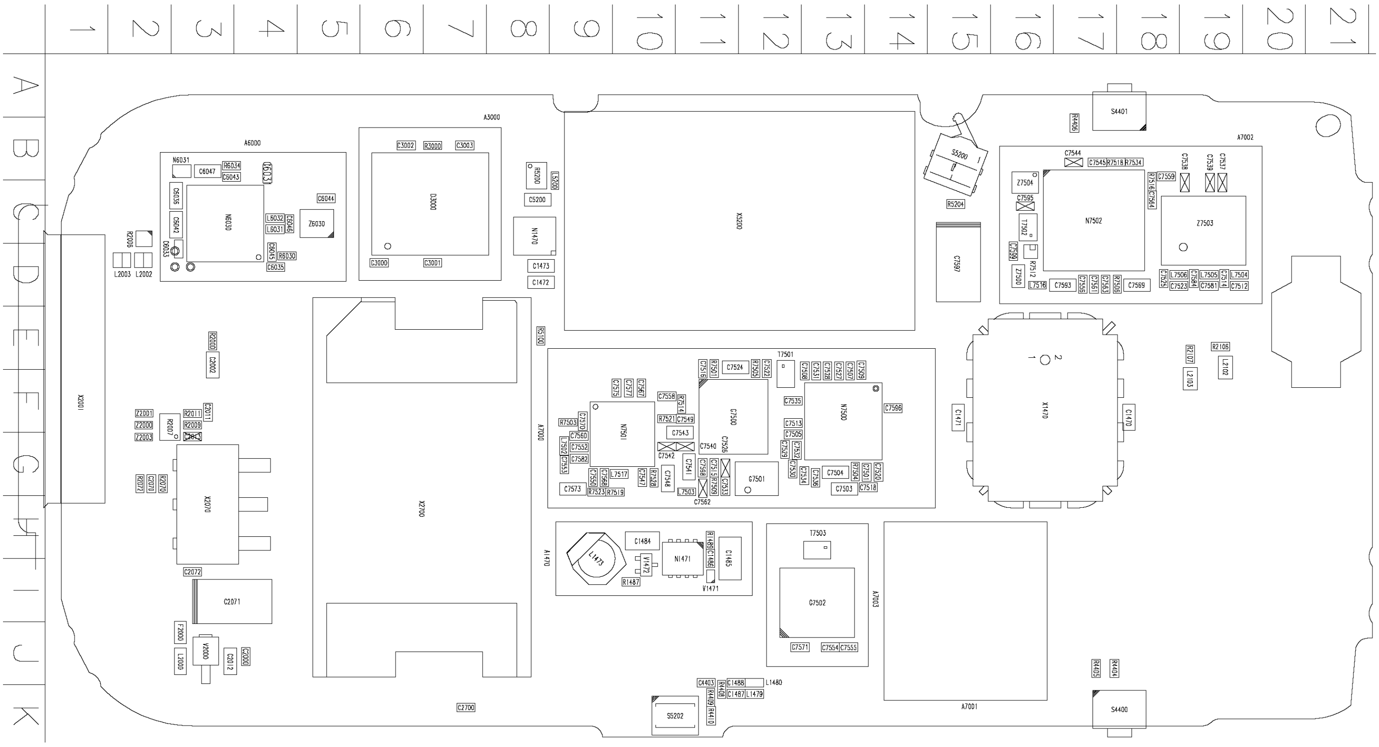
Item	Side	Grid reference		Description and Value			Type
Z4403	Top	~J	8	ASIP 10-CH ESD EMI FILTER BGA25	~	~	uBGA25_2.69X2.69
Z6030	BTM	~C	5	LTCC FILT 2441.75 +-41.75MHZ 2.5X2	2441.75MHz	~	EZFVQ42NM61S
Z7500	BTM	~D	16	FERRITE BEAD 0R01 28R/100MHZ 0603	28R/100MHz	~	FERRITE_FBMJ1608
Z7503	BTM	~C	19	ANT.SW +3SAW 880-960/1710-1990MHZ	~	~	ANT_SW_M043B
Z7504	BTM	~C	16	SAW FILTER 897.5 +-17.5MHZ 2.0X1.6	897.5MHz	~	FILTER_SAW_2.1X1.7_H0.8

Variant parts for RM-58

Item	EU description	US description
Z7503	ANT.SW+3SAW 880-960/1710-1990MHZ	RF SWITCH MODULE ESHS-L080SQ-Ver.1.0
Z7504	SAW FILTER 897.5+-17.5MHZ 2.0X1.6	SAW FILTER 836.5+-12.5MHZ/2.0X1.6
I042	Antenna GSM900/1800/1900	Antenna GSM850/1800/1900

Component layouts

Component layout - bottom (1LF_09a)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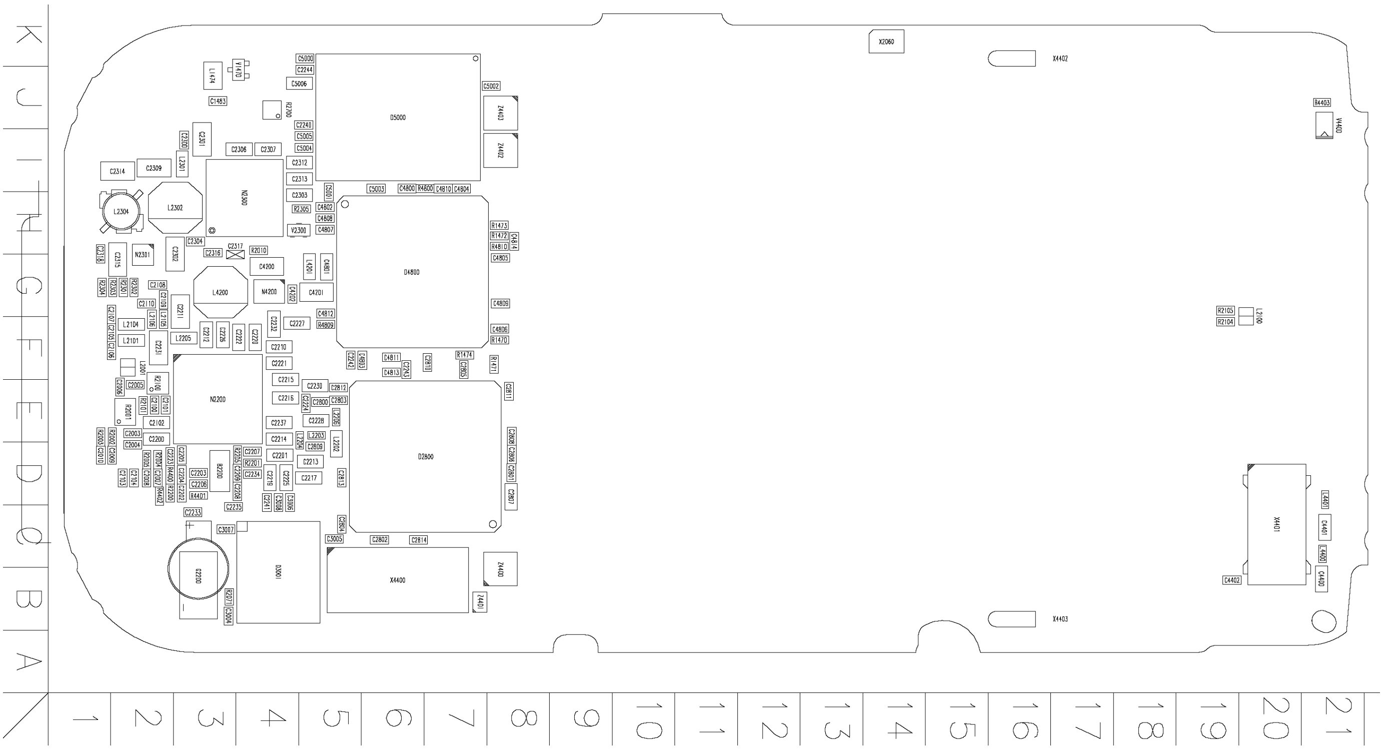
A6000
A3000
D3000
X5000
S5200
S4401
A7002
N7502
Z7503
N6031
N6030
Z6030
X2001
X2010
X2700
A7000
N7501
N7500
G7500
G7501
X1470
N1471
G7502
A7003
A7001
S5202
S4400
C2071

Component layout - top (1LF_09a)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D5000
N2300
L2304
L2302
N2301
L4200
N4200
D4800
N2200
D2800
B2200
D3001
X4400
X2060
X4402
X4403
X4401
Z4400

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3 — Service Software Instructions

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Phoenix installation steps in brief

Phoenix is the service software for reprogramming, testing and tuning the phone.

Recommended PC HW requirements:

- Computer Processor: Pentium 700 MHz or higher
- RAM 256 MB
- Disk space 100-200 MB

Supported operating systems:

- Windows 2000 Service Pack 3 or higher
- Windows XP Service Pack 1 or higher

To install Phoenix, you need to:

- Connect a DK2 Dongle
- Install the Phoenix Service SW
- Install the Data Package for Phoenix
- Configure users
- Manage connection settings (depends on the tools you are using)

If you use FPS-8:

- Update FPS-8 SW
- Activate FPS-8

If you use FPS-10:

- Update FPS-10 SW

  Note: There is no need to activate FPS-10.
- Activate SX-4 Smart Card if you need tuning and testing functions in service software

  Note: When FPS-10 is used only for product SW updates, SX-4 Smart card is not needed.

Phoenix is now ready to be used with FPS-8 or FPS-10 flash prommers and other tools as well.

The Phoenix Service Software installation contains:

- Service software support for all phone models included in the package
- Flash update package files for programming devices
- All needed drivers for:
  - DK2 dongle
  - DKU-2 USB cable

  Note: Separate installation packages for flash update files and drivers are also available, but it is not necessary to use them unless updates appear between Phoenix Service SW releases. If separate update packages are used, they should be used after Phoenix and data packages have been installed.

The phone model specific data package includes all changing product specific data:

- Product software Binary files
- Files for type label printing
- Validation file for the Faultlog repair data reporting system
- All product specific configuration files for Phoenix software components

  Note: Phoenix Service SW and phone data packages should only be used as complete installation packages. Uninstallation should be made from the Windows Control Panel.

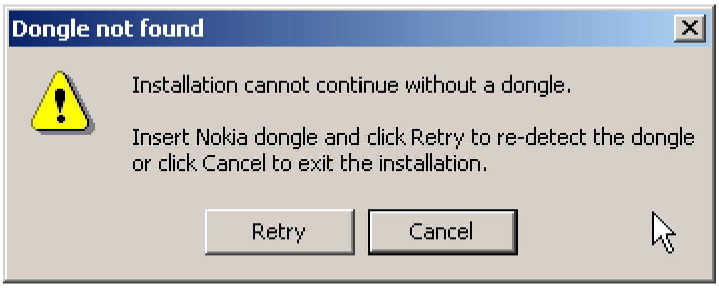
Installing Phoenix

Before you begin

- Check that a dongle is attached to the parallel port of your computer.
- Download the installation package (for example, *phoenix_service_sw_2004_39_x_xx.exe*) to your computer (in *C:\TEMP*, for instance).
- Close all other programs.
- Depending on the operating system, administrator rights may be required to be able to install Phoenix .
- If uninstalling or rebooting is needed at any point, you will be prompted by the InstallShield program.

Context

At some point during the installation procedure you may get the following message:


Dongle not found

Installation cannot continue without a dongle.

Insert Nokia dongle and click Retry to re-detect the dongle or click Cancel to exit the installation.

Figure 2 Dongle not found

One possible reason may be a defective or too old PKD-1 dongle (five digit serial number dongle when used with FPS-8/FPS-10 prommers).

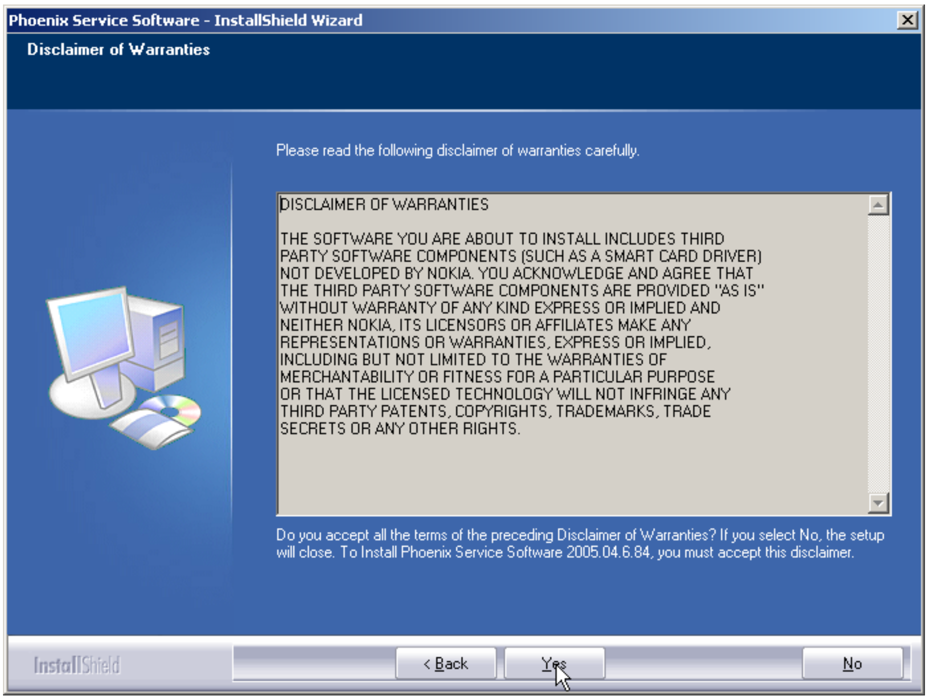
Check the COM/parallel ports used first! After correcting the problem Installation can be restarted.

For more detailed information, please refer to Phoenix Help files. Each feature in Phoenix has its own Help function, which can be activated while running the program. Press the **F1** key or the feature's **Help** button to activate a Help file.

Steps

1. To start installation, run the application file (for example,*phoenix_service_sw_2004_39_x_xx.exe*).
2. In the Welcome dialogue, click Next.

3. Read the disclaimer text carefully and click Yes.



Please read the following disclaimer of warranties carefully.

DISCLAIMER OF WARRANTIES

THE SOFTWARE YOU ARE ABOUT TO INSTALL INCLUDES THIRD PARTY SOFTWARE COMPONENTS (SUCH AS A SMART CARD DRIVER) NOT DEVELOPED BY NOKIA. YOU ACKNOWLEDGE AND AGREE THAT THE THIRD PARTY SOFTWARE COMPONENTS ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND EXPRESS OR IMPLIED AND NEITHER NOKIA, ITS LICENSORS OR AFFILIATES MAKE ANY REPRESENTATIONS OR WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR THAT THE LICENSED TECHNOLOGY WILL NOT INFRINGE ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADEMARKS, TRADE SECRETS OR ANY OTHER RIGHTS.

Do you accept all the terms of the preceding Disclaimer of Warranties? If you select No, the setup will close. To Install Phoenix Service Software 2005.04.6.84, you must accept this disclaimer.

Figure 3 Disclaimer text

4. Choose destination folder.

   The default folder *C:\ProgramFiles\Nokia\Phoenix* is recommended.

5. To continue, click Next.

   You may choose another location by selecting Browse (not recommended).

6. Wait for the components to be copied.

   The progress of the setup is shown in the *Setup Status* window.

7. Wait for the drivers to be installed and updated.

   The process may take several minutes to complete.

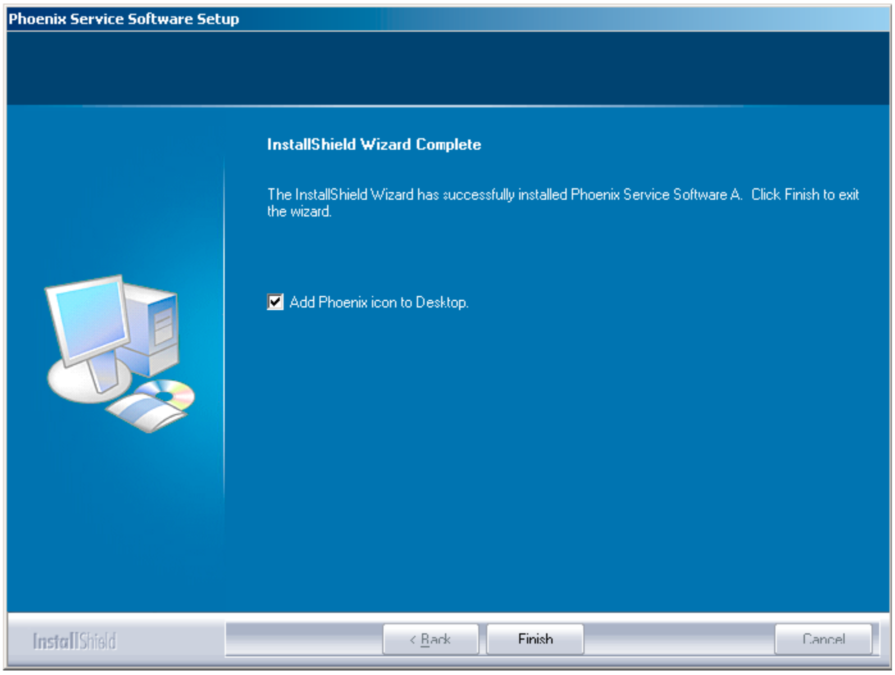
   If the operating system does not require rebooting, the PC components are registered right away.

   If the operating system used requires restarting your computer, the Install Shield Wizard will tell you about it. Select **Yes...** to reboot the PC immediately and **No..** to reboot the PC manually afterwards.

   After the reboot, components are registered and Phoenix is ready for use.

   Note: Phoenix does not work, if components have not been registered.

8. To end installation, click Finish .



InstallShield Wizard Complete

The InstallShield Wizard has successfully installed Phoenix Service Software A. Click Finish to exit the wizard.

☑ Add Phoenix icon to Desktop.

Figure 4 InstallShield Wizard Complete

Phoenix is now ready for use.

Next action

After the installation, Phoenix service software can be used after:

- installing phone model specific data package for Phoenix
- configuring users and connections

FPS-8* and FPS-10 flash prommers can be used after updating their Flash Update Package files.

Updating Phoenix installation

If you already have the Phoenix service software installed on your computer, you need to update the software when new versions are released.

When you update Phoenix (for example, **a14_2004_16_4_47** to **a15_2004_24_7_55**), the update will take place automatically without uninstallation.

Always use the latest available versions of both Phoenix and the phone-specific data package. Instructions can be found in the phone model specific Technical Bulletins and phone data package readme.txt files (shown during installation).

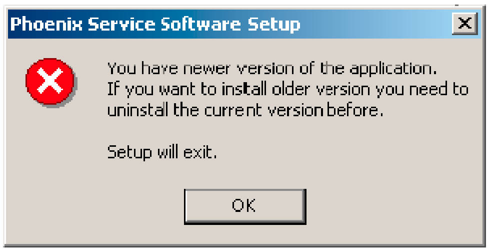
To update Phoenix, you need to follow the same steps as when installing it for the first time:

- Download the installation package to your computer hard disk.
- Close all other programs.
- Run the application file (for example, phoenix_service_sw_2004_39_x_xx.exe).

A new Phoenix version will be installed and driver versions will be checked and updated.

If you try to update the Phoenix with the same version you already have (for example, **a15_2004_24_7_55** to **a15_2004_24_7_55**) you are asked if you want to uninstall the existing version of Phoenix. In this case you can choose between a total uninstallation and repair just like when you choose to uninstall Phoenix service software from the Windows Control panel.

If you try to install an older version (for example, downgrade from **a15_2004_24_7_55** to **a14_2004_16_4_47**), installation will be interrupted.


Phoenix Service Software Setup

You have newer version of the application.
If you want to install older version you need to uninstall the current version before.

Setup will exit.

Figure 5 Installation interrupted

Always follow the instructions on the screen.

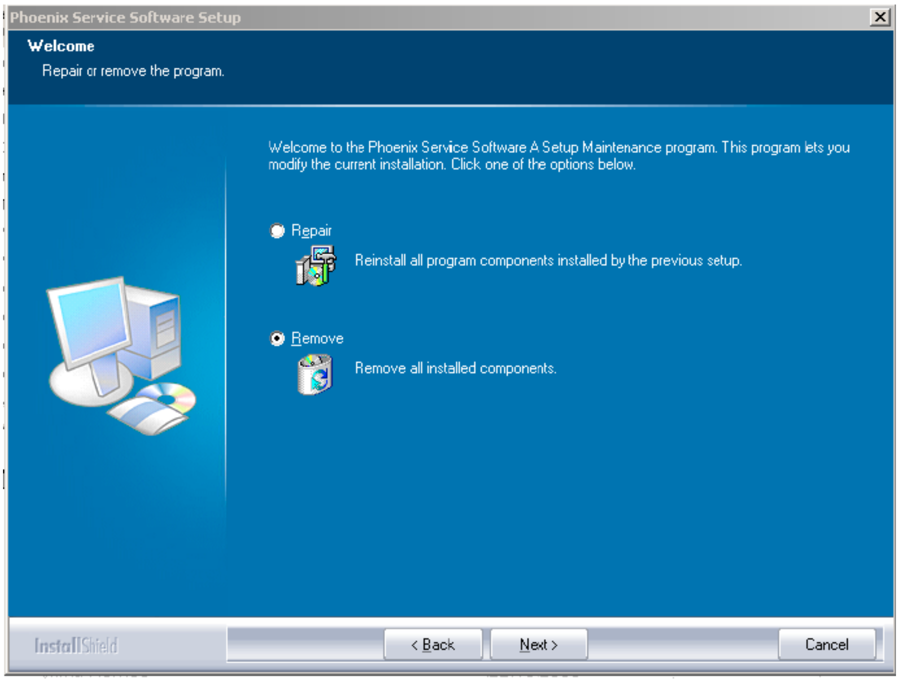
Uninstalling Phoenix

Context

You can uninstall Phoenix service software manually from the Windows Control Panel.

Steps

1. Open the Windows Control Panel and choose Add/Remove Programs.
2. To uninstall Phoenix, choose *Phoenix Service Software* → *Change/Remove* → *Remove* .


Phoenix Service Software Setup

Welcome

Repair or remove the program.

Welcome to the Phoenix Service Software A Setup Maintenance program. This program lets you modify the current installation. Click one of the options below.

○ Repair

Reinstall all program components installed by the previous setup.

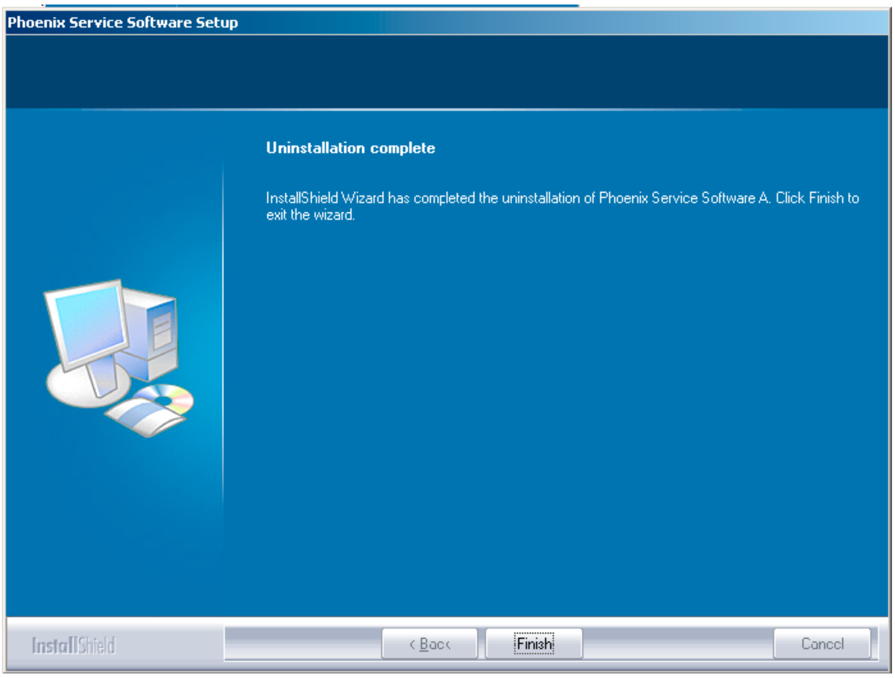
● Remove

Remove all installed components.

Figure 6 Remove program

The progress of the uninstallation is shown.

3. If the operating system does not require rebooting, click Finish to complete.



Uninstallation complete

InstallShield Wizard has completed the uninstallation of Phoenix Service Software A. Click Finish to exit the wizard.

Figure 7 Finish uninstallation

If the operating system requires rebooting, InstallShield Wizard will notify you. Select Yes... to reboot the PC immediately and No... to reboot the PC manually afterwards.

Repairing Phoenix installation

Context

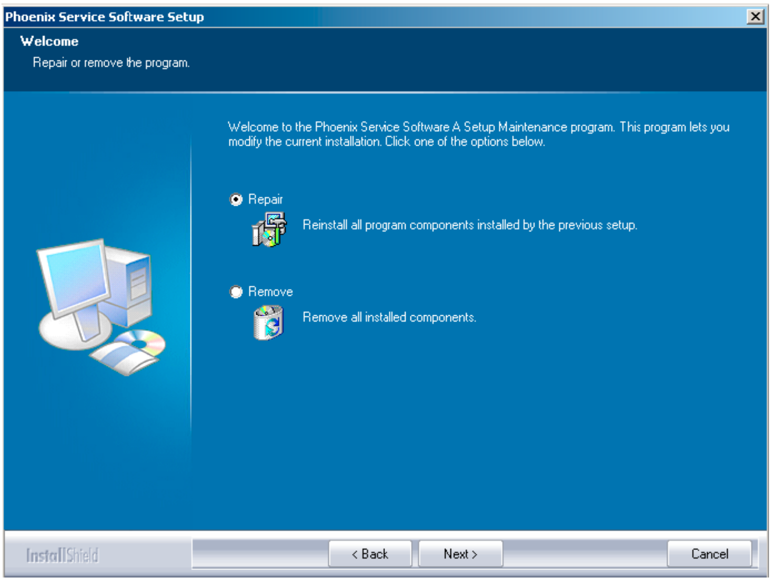
If you experience any problems with the service software or suspect that files have been lost, you can use the repair function before completely reinstalling Phoenix.

Note: The original installation package (for example, *phoenix_service_sw_a15_2004_24_7_55.exe*) must be found on your PC when you run the repair setup.

Steps

1. Open *Windows Control Panel* → *Add/Remove Programs* .
2. Select *Phoenix Service Software* → *Change/Remove* .

3. In the following view, select Repair.



Phoenix Service Software Setup

Welcome

Repair or remove the program.

Welcome to the Phoenix Service Software A Setup Maintenance program. This program lets you modify the current installation. Click one of the options below.

● Repair

Reinstall all program components installed by the previous setup.

○ Remove

Remove all installed components.

Figure 8 Repair program

Phoenix will now reinstall components and register them.

The procedure is the same as when updating Phoenix.

4. To complete the repair, click Finish.

Phoenix service software data package overview

Each product has its own data package (DP). The product data package contains all product-specific data files to make the Phoenix service software and tools usable with a certain phone model.

The data package contains the following:

- Product software Binary files
- Files for type label printing
- Validation file for the Faultlog repair data reporting system
- All product-specific configuration files for Phoenix software components

Data files are stored under **C:\Program Files\Nokia\Phoenix** (default).

Installing Phoenix data package

Before you begin

- A product-specific data package contains all data to make the Phoenix service software and tools usable with a certain phone model.
- Check that the dongle is attached to the parallel port of your computer.
- Install Phoenix service SW.
- Download the installation package (for example, XX-XX*_dp_EA_v_1_0.exe) to your computer (for example, in *C:\TEMP*).
- Close all other programs.

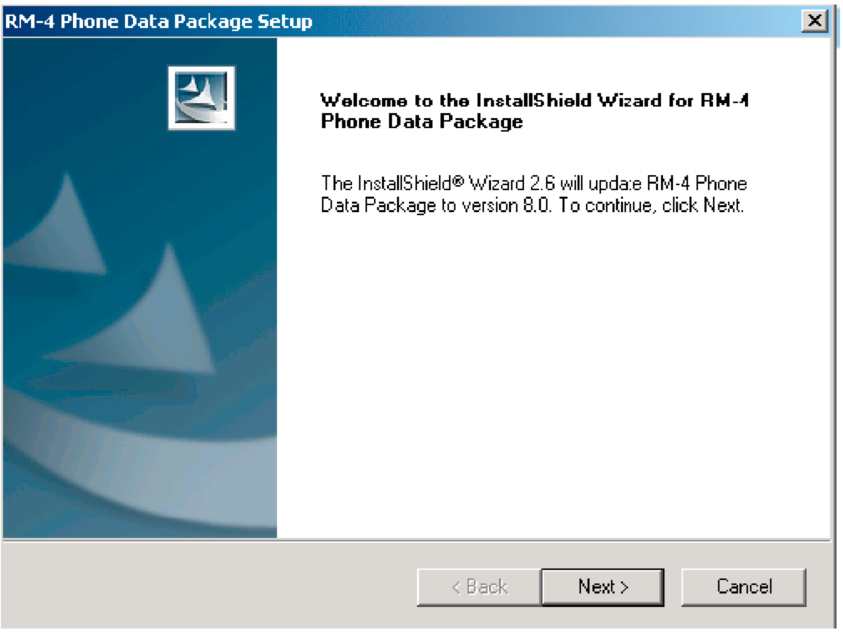
(* = type designator of the product)

If you already have Phoenix installed on your computer, you will need to update it when a new version is released.

Note: Very often the Phoenix Service SW and the phone-specific data package for Phoenix come in pairs, meaning that a certain version of Phoenix can only be used with a certain version of the data package. Always use the latest available versions of both. Instructions can be found in phone model specific Technical Bulletins and *readme.txt* files of the data packages.

Steps

1. To start installation, run the application file (for example, *XX-XX_dp_EA_ v_1_0.exe*).
2. Click Next, and wait for the installation files to be extracted.
3. To continue, click Next .



RM-4 Phone Data Package Setup

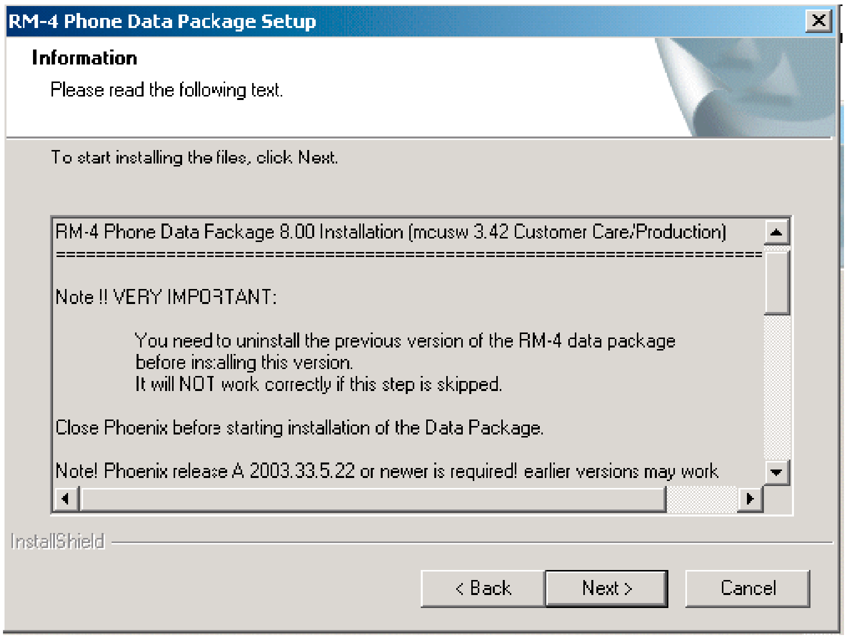
Welcome to the InstallShield Wizard for RM-4 Phone Data Package

The InstallShield® Wizard 2.6 will update RM-4 Phone Data Package to version 8.0. To continue, click Next.

Figure 9 Continue data package installation

In this view you can see the contents of the data package. Read the text carefully. There should be information about the Phoenix version required with this data package.

4. To continue, click Next .



RM-4 Phone Data Package Setup

Information

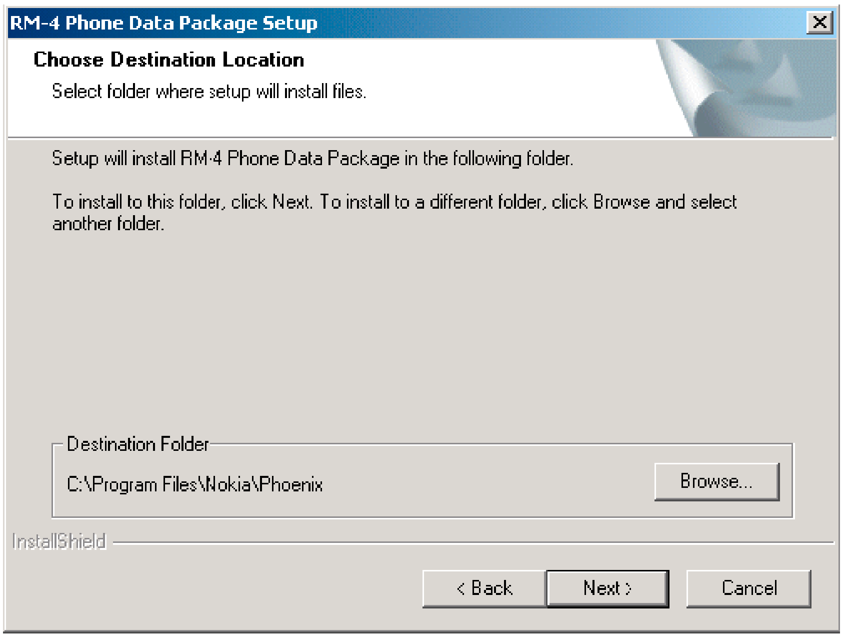
Please read the following text.

To start installing the files, click Next.

```
RM-4 Phone Data Package 8.00 Installation (mcusw 3.42 Customer Care/Production)
=======================================================================

Note !! VERY IMPORTANT:

          You need to uninstall the previous version of the RM-4 data package
          before installing this version.
          It will NOT work correctly if this step is skipped.

Close Phoenix before starting installation of the Data Package.

Note! Phoenix release A 2003.33.5.22 or newer is required! earlier versions may work
```

Figure 10 Data package setup information

5. Confirm location and click Next to continue.



RM-4 Phone Data Package Setup

Choose Destination Location

Select folder where setup will install files.

Setup will install RM-4 Phone Data Package in the following folder.

To install to this folder, click Next. To install to a different folder, click Browse and select another folder.

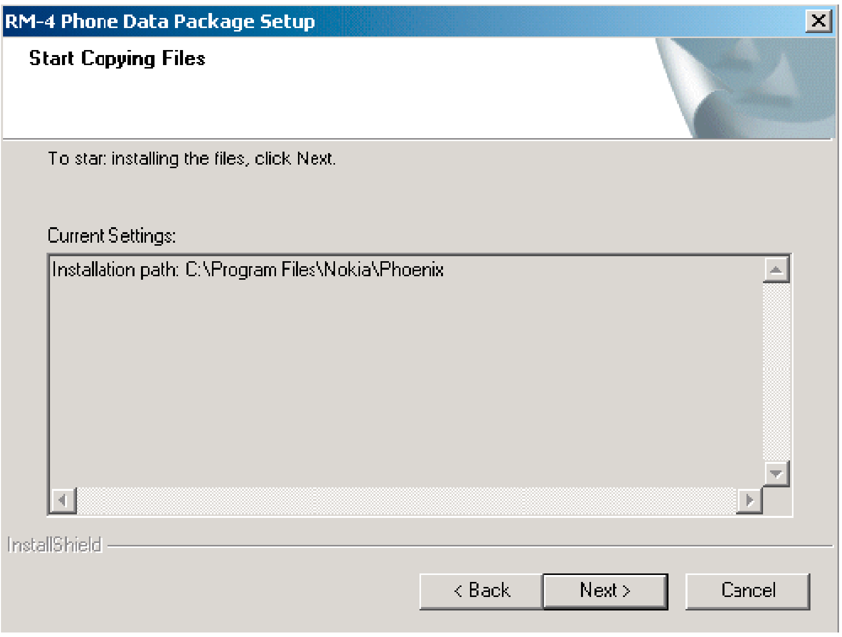
Destination Folder

C:\Program Files\Nokia\Phoenix

Figure 11 Data package destination folder

The install shield checks where the Phoenix application is installed and the directory is shown.

6. To start copying the files, click Next.



RM-4 Phone Data Package Setup
InstallShield
< Back
Next >
Cancel

Start Copying Files

To start installing the files, click Next.

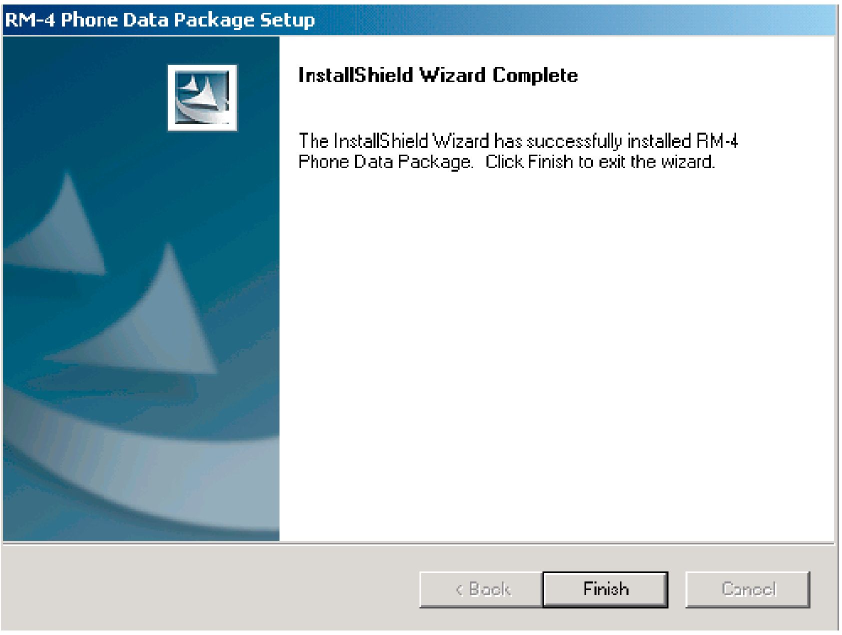
Current Settings:

Installation path: C:\Program Files\Nokia\Phoenix

Figure 12 Start copying files

Phone model specific files are installed. Please wait.

7. To complete the installation, click Finish.



RM-4 Phone Data Package Setup
< Back
Finish
Cancel

InstallShield Wizard Complete

The InstallShield Wizard has successfully installed RM-4 Phone Data Package. Click Finish to exit the wizard.

Figure 13 Finish data package installation

You now have all phone model specific files installed in your Phoenix Service SW.

Next action

Phoenix can be used, for example, for flashing phones and printing type labels after:

- Configuring users
- Managing connections

FPS-8* and FPS-10 can be used after updating their Flash Update Package files.

Uninstalling Phoenix data package

Context

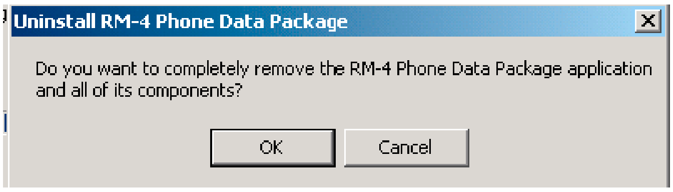
If you try to install the same version of the Phoenix data package that you already have, you are asked if you want to uninstall the existing version.

There is no need to uninstall the older version of a data package, unless instructions to do so are given in the *readme.txt* file of the data package and bulletins related to the release.

Please read all related documents carefully.

Steps

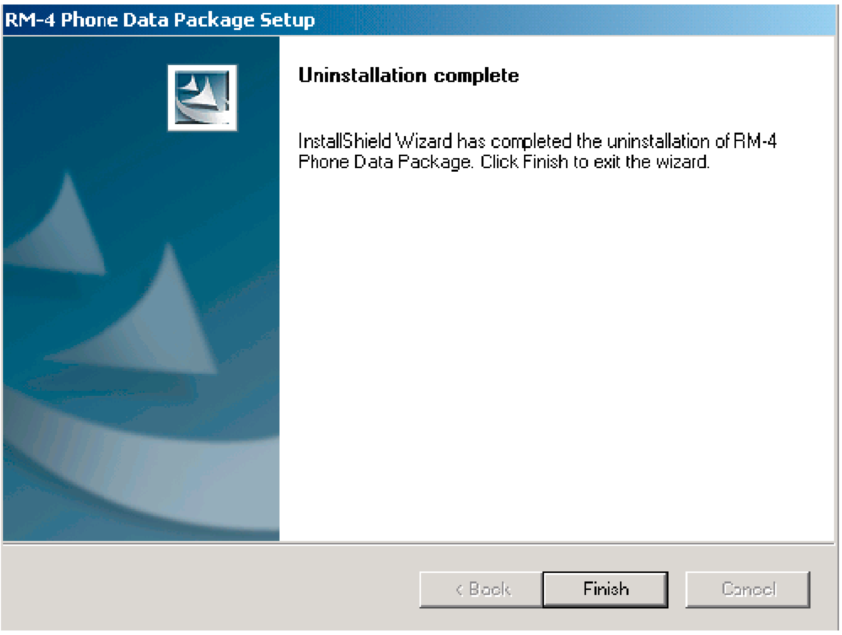
1. To uninstall the data package, click OK Cancel to interrupt the uninstallation.


Uninstall RM-4 Phone Data Package

Do you want to completely remove the RM-4 Phone Data Package application and all of its components?

Figure 14 Uninstalling Phoenix data package

2. Once the previously installed data package is uninstalled, click Finish.


RM-4 Phone Data Package Setup

Uninstallation complete

InstallShield Wizard has completed the uninstallation of RM-4 Phone Data Package. Click Finish to exit the wizard.

Figure 15 Finishing data package uninstallation

Alternative steps

- You can also uninstall the data package manually from *Windows Control Panel* → *Add/Remove Programs* → *xx-xx * Phone Data Package* . (*= type designator of the phone)

Next action

Run the installation package again to continue installation from the beginning.

Configuring users in Phoenix

Steps

1. Start Phoenix Service SW and log in.

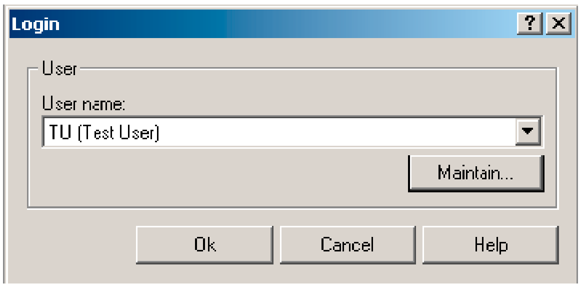

Login
User
User name:
TU (Test User)
Maintain...
Ok
Cancel
Help

Figure 16 Login

   If the user ID is already configured, choose it from the dropdown list and click OK.

   To add a new user or edit existing ones, click Maintain.

2. To add information for a new user, click New.
3. Type in the name and initials of the user and click OK.

   A new user is now created.

4. Click OK.

   You are now able to login with the user name created.

5. Click OK.

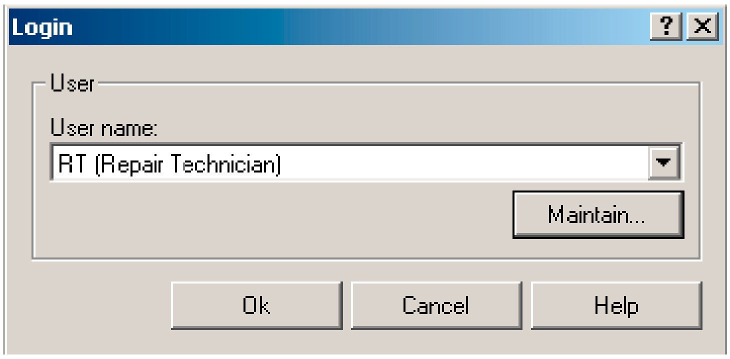

Login
User
User name:
RT (Repair Technician)
Maintain...
Ok
Cancel
Help

Figure 17 Login, user configured

Managing connections in Phoenix

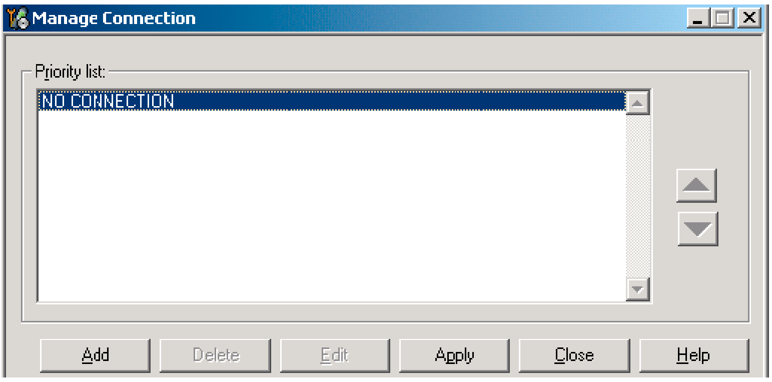
Context

With the Manage Connections feature you can edit and delete existing connections and create new ones.

Steps

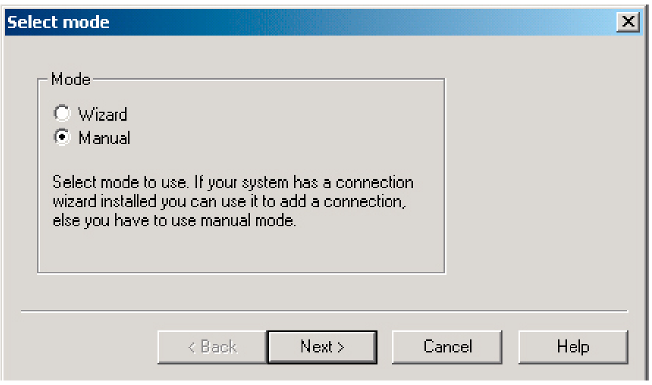
1. Start *Phoenix Service SW* and log in.
2. Choose *File* → *Manage Connections* .

3. To add a new connection, click Add, and select if you want to create it manually or by using the Connection Wizard.



In the following dialogs you are asked to select settings for the connection. If you use the Wizard, connect the tools and a phone to your PC and the wizard will automatically try to configure the correct connection.

4. Select Manual mode, and click Next to continue.



Select mode to use. If your system has a connection wizard installed you can use it to add a connection, else you have to use manual mode.

Figure 18 Select mode: Manual

i For an FPS-10 flash prommer with a **USB Connection**, choose the following connection settings

- Media: FPS-10 USB
- Device Index: 0
- Serial Num: See Serial No from the label attached to the bottom of your FPS-10
- Active Media: USB

ii For an FPS-10 flash prommer with a **LAN connection**, choose the following connection settings

- Media: FPS-10 TCP/IP
- Net Serv Name: Select “Scan”. Choose your own FPS-10 device based on the correct MAC address. See Serial No from the label attached to the bottom of your FPS-10.
- Port Num: Use default value, click “Next”.
- Protocol Family: Use default value, click “Next”.
- Socket Type: Use default value, click “Next”.
- TX Buffer Size: Use default value, click “Next”.
- RX Buffer Size: Use default value, click “Next”.

Note: When the phone is connected to a PC for the first time, allow the PC to install the USB device drivers first.

Please note that this may take some time to complete.

After the drivers are installed and if there are problems, check that the USB connection is active from the Windows Control Panel or contact the local PC support.

iii For an FPS-8 flash prommer, choose the following connection settings:

- Media: FPS-8
- Port Num: COM Port where FPS-8 is connected
- COMBOX_DEF_MEDIA: FBUS

iv For a plain **USB connection** choose the following connection settings:

Note: First connect the DKU-2 USB cable between the PC USB port and phone.

- Media: USB

Note: When the phone is connected to a PC for the first time, allow the PC to install the USB device drivers first.

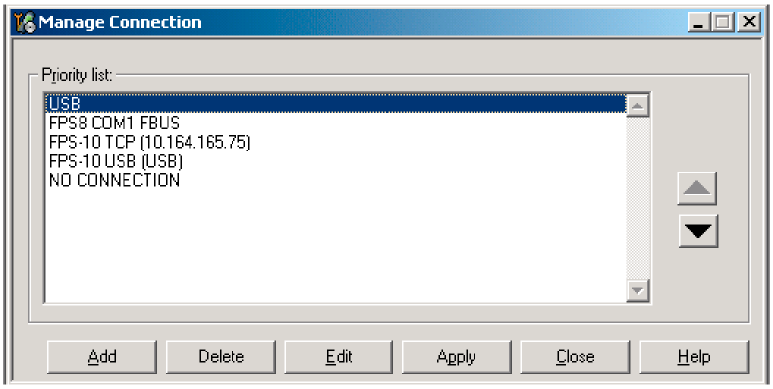
Please note that this may take some time to complete.

After the drivers are installed and if there are problems, check that the USB connection is active from the Windows Control Panel or contact the local PC support.

5. To complete the configuration, click Finish.

   If you are using the Wizard, connect the tools and a phone to your PC and the wizard will automatically try to configure the correct connection. Please note that this may take time because Phoenix will go through all connections on the PC.

6. Click the connection you want to activate and use up/down arrows to move it on top of the list, then click Apply.



USB
FPS8 COM1 FBUS
FPS-10 TCP (10.164.165.75)
FPS-10 USB (USB)
NO CONNECTION

Figure 19 Connections list

The connection is now selected and can be used after closing the *Manage Connections* window.

The selected connection is shown on the right hand bottom corner of the screen.

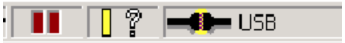


Figure 20 Connection information

7. To use the selected connection, connect the phone to Phoenix with correct service tools, make sure that the phone is switched on and from the File menu, choose Scan Product.

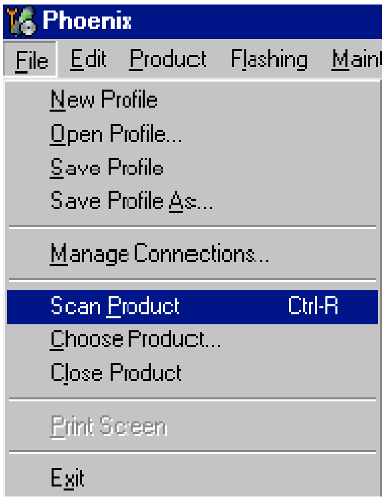
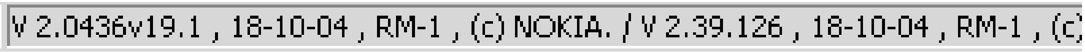

Phoenix
File
Edit
Product
Flashing
Maint
New Profile
Open Profile...
Save Profile
Save Profile As...
Manage Connections...
Scan Product
Ctrl-R
Choose Product...
Close Product
Print Screen
Exit

Figure 21 Scan product



```
V 2.0436v19.1 , 18-10-04 , RM-1 , (c) NOKIA. / V 2.39.126 , 18-10-04 , RM-1 , (c
```

Figure 22 Product support module information

Installing flash support files for FPS-8 and FPS-10

Before you begin

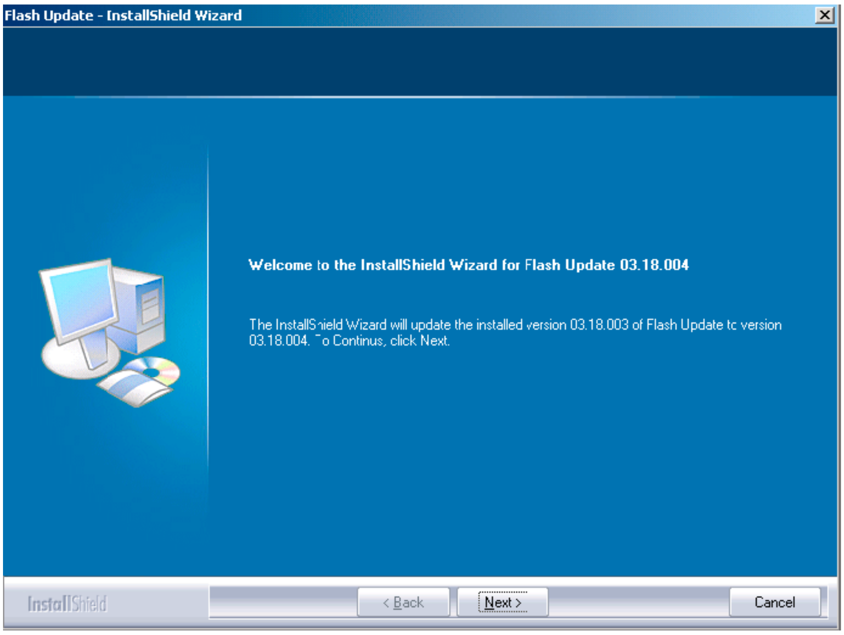
- Install Phoenix Service SW.
- Install phone model specific data package for Phoenix.
- If you want to update the flash support files, they are delivered in the same installation package with Phoenix or newer Phoenix packages beginning from December 2004. In case you want to update the MCU files, install the latest data package (see Technical Bulletins for information on the latest one). However, normally it is enough to install Phoenix and the phone-specific data package because the Phoenix installation always includes the latest flash update package files for FPS-8 and FPS-10.
- A separate installation package for flash support files is available, and the files can be updated according to this instruction if updates appear between Phoenix/data package releases.

Context

If you are not using a separate installation package, you can skip this section and continue with Updating FPS-8 and FPS-10 flash prommer software (Page 3–22) after installing a new phone data package.

Steps

1. To begin the installation, double-click the flash update file (for example, *flash_update_03_183_0014.exe*).



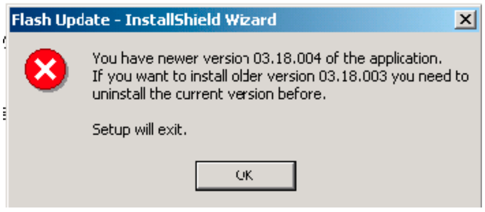
Welcome to the InstallShield Wizard for Flash Update 03.18.004

The InstallShield Wizard will update the installed version 03.18.003 of Flash Update to version 03.18.004. To Continue, click Next.

Figure 23 Flash update welcome dialog

If the same version of Flash Update package already exists, and you want to reinstall it, the previous package is first uninstalled. Restart installation again after uninstallation.

2. If you try to downgrade the existing version to older ones, the setup will be aborted. If there is a need to downgrade the version, uninstall newer files manually from the Windows Control Panel and then rerun the installation.



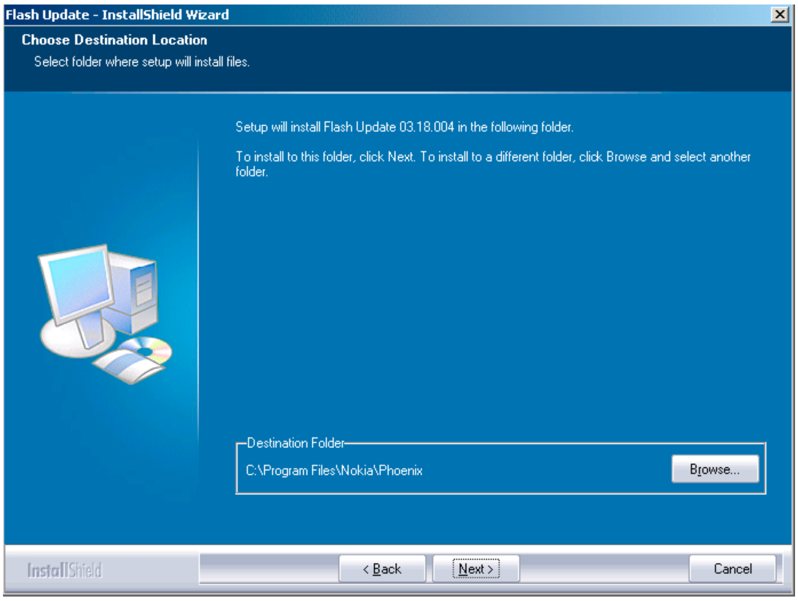
You have newer version 03.18.004 of the application.
If you want to install older version 03.18.003 you need to uninstall the current version before.

Setup will exit.

Figure 24 Flash installation interrupted

If an older version exists on your PC and it needs to be updated, click Next to continue installation.

3. It is highly recommended to install the files to the default destination folder *C:\Program Files\Nokia\Phoenix*. To continue, click Next.



Flash Update - InstallShield Wizard

Choose Destination Location

Select folder where setup will install files.

Setup will install Flash Update 03.18.004 in the following folder.

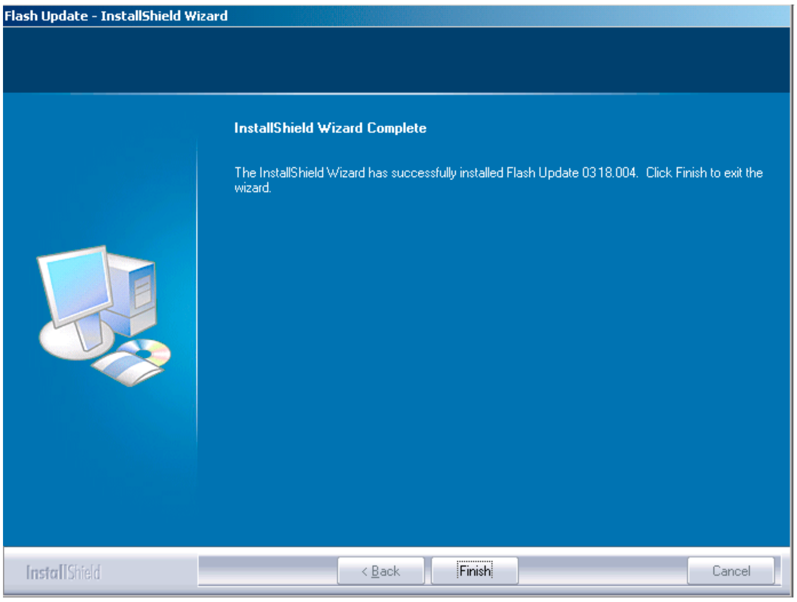
To install to this folder, click Next. To install to a different folder, click Browse and select another folder.

Destination Folder: C:\Program Files\Nokia\Phoenix

Figure 25 Flash destination folder

When installing the flash update files for the first time, you may choose another location by selecting Browse (not recommended).

4. To complete the installation procedure, click Finish .



Flash Update - InstallShield Wizard

InstallShield Wizard Complete

The InstallShield Wizard has successfully installed Flash Update 03.18.004. Click Finish to exit the wizard.

Figure 26 Finish flash update

Next action

FPS-8 and FPS-10 flash prommers must be updated using Phoenix!

Updating FPS-8 and FPS-10 flash prommer software

Steps

1. Start *Phoenix Service Software* and log in, manage connection correctly for your flash prommer.
2. Choose *Maintenance* → *Prommer maintenance* .

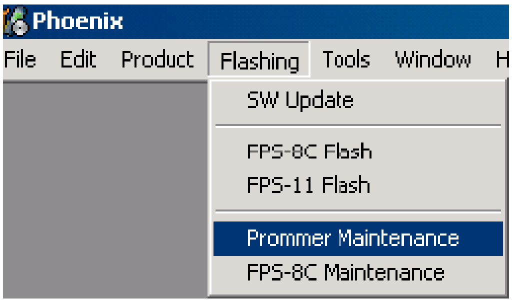
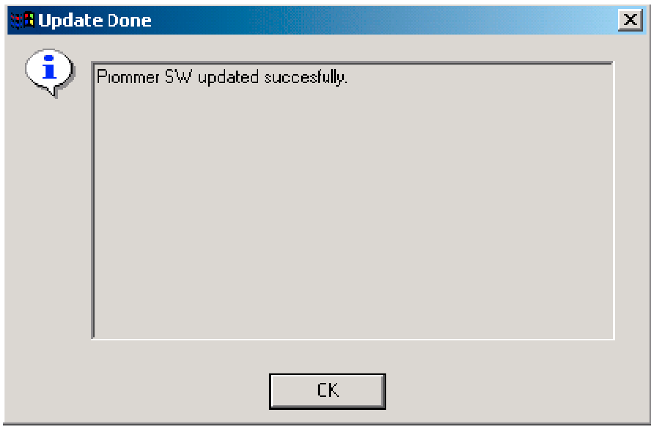

Phoenix
File
Edit
Product
Flashing
Tools
Window
H
SW Update
FPS-8C Flash
FPS-11 Flash
Prommer Maintenance
FPS-8C Maintenance

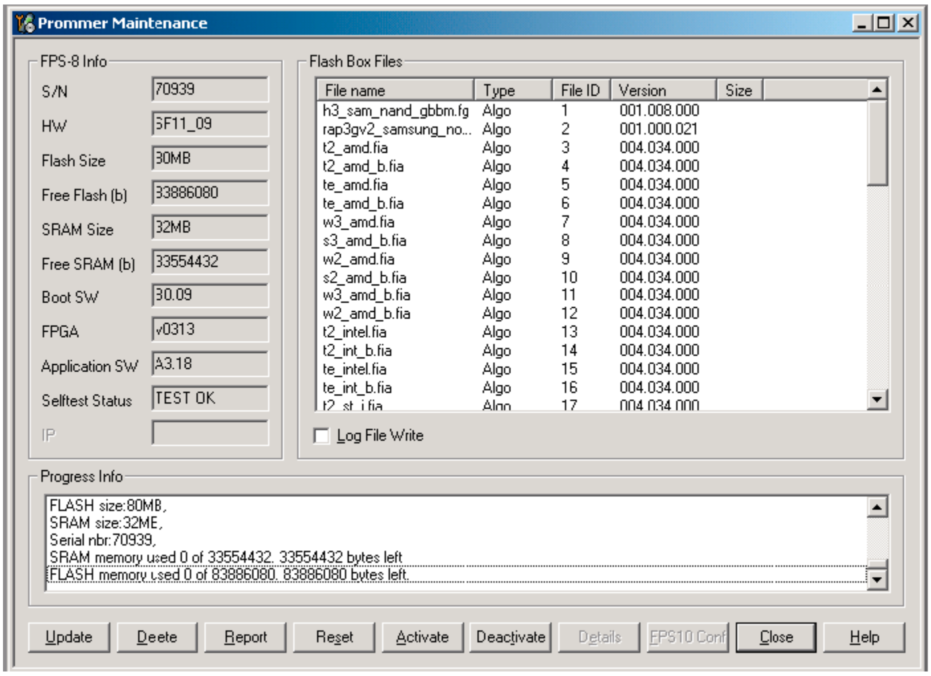
Figure 27 Choosing Prommer maintenance

3. When the new flash update package is installed to computer, you aree asked to update the files to your prommer. To update the files, click Yes.
4. Wait until you are notified that the update has been successful; the procedure will take a couple of minutes. To close the *Prommer Maintenance* window, click OK.


Update Done
OK

Prommer SW updated succesfully.

Figure 28 Prommer SW update finished


Prommer Maintenance
FPS-8 Info
Flash Box Files
Progress Info
Update
Deete
Report
Reset
Activate
Deactivate
Details
FPS10 Conf
Close
Help

S/N 70939
HW 5F11_09
Flash Size 30MB
Free Flash (b) 33886080
SRAM Size 32MB
Free SRAM (b) 33554432
Boot SW 30.09
FPGA v0313
Application SW A3.18
Selftest Status TEST OK
IP

File name	Type	File ID	Version	Size
h3_sam_nand_gbbm.fg	Algo	1	001.008.000	
rap3gv2_samsung_no...	Algo	2	001.000.021	
t2_amd.fia	Algo	3	004.034.000	
t2_amd_b.fia	Algo	4	004.034.000	
te_amd.fia	Algo	5	004.034.000	
te_amd_b.fia	Algo	6	004.034.000	
w3_amd.fia	Algo	7	004.034.000	
s3_amd_b.fia	Algo	8	004.034.000	
w2_amd.fia	Algo	9	004.034.000	
s2_amd_b.fia	Algo	10	004.034.000	
w3_amd_b.fia	Algo	11	004.034.000	
w2_amd_b.fia	Algo	12	004.034.000	
t2_intel.fia	Algo	13	004.034.000	
t2_int_b.fia	Algo	14	004.034.000	
te_intel.fia	Algo	15	004.034.000	
te_int_b.fia	Algo	16	004.034.000	
t2_st_i.fia	Algo	17	004.034.000	

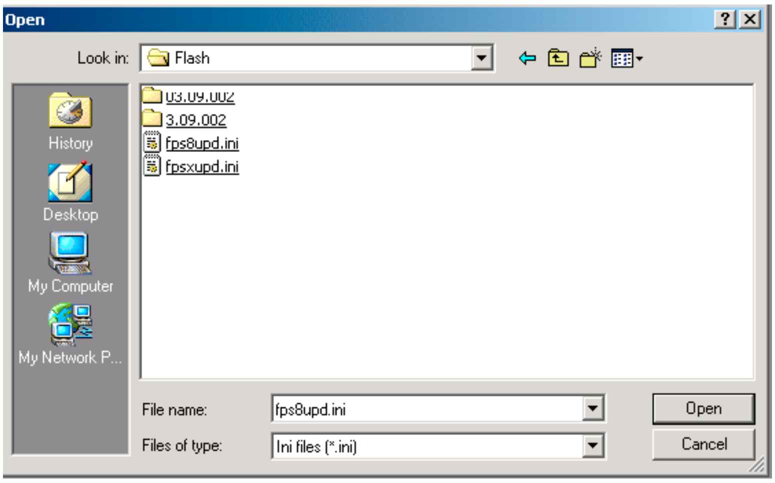
☐ Log File Write

```
FLASH size:80MB,
SRAM size:32ME,
Serial nbr:70939,
SRAM memory used 0 of 33554432. 33554432 bytes left
FLASH memory used 0 of 83886080. 83886080 bytes left.
```

Figure 29 Prommer maintenance window

Alternative steps

- To update the **FPS-8** SW, click theUpdate button and select the appropriate *fps8upd.ini* file in *C:\Program Files\Nokia\Phoenix\Flash*.
- To update the **FPS-10** SW, click the Update button and select the appropriate *fpsxupd.ini* file in *C:\Program Files\Nokia\Phoenix\Flash*.


Open
History
Desktop
My Computer
My Network P...
Open
Cancel

Look in: Flash

03.09.002
3.09.002
fps8upd.ini
fpsxupd.ini

File name: fps8upd.ini
Files of type: Ini files (*.ini)

Figure 30 Flash directory window

- All files can be loaded separately to the prommer used. To do this, click the right mouse button in the *Flash box files* window and select the file type to be loaded.

  More information can be found in the Phoenix Help.

Activating FPS-8

Context

Before FPS-8 can be successfully used for phone programming, it must first be activated.

First fill in the *FPS-8 activation request* sheet in the FPS-8 sales package and follow the instructions given.

When activation file is received (for example, *00000.in*), copy it to the *C:\ProgramFiles\Nokia\Phoenix\BoxActivation* directory on your computer (this directory is created when Phoenix is installed).

Steps

1. Start *Phoenix Service Software*.
2. Choose *Maintenance* → *Prommer Maintenance* .

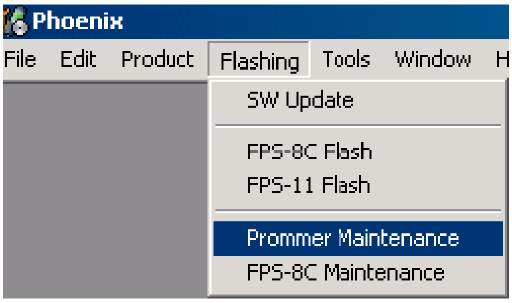
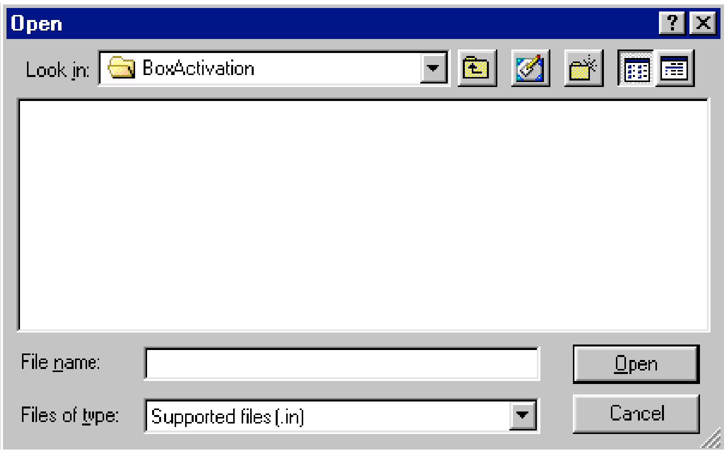

Phoenix
File
Edit
Product
Flashing
Tools
Window
H
SW Update
FPS-8C Flash
FPS-11 Flash
Prommer Maintenance
FPS-8C Maintenance

Figure 31 Prommer maintenance

3. In the *Prommer Maintenance* window, click Activate.
4. To find the activation file if you saved it to some other directory on your PC, click Browse.
5. To activate the prommer, select the activation file and click Open.


Open
?
Look in:
File name:
Open
Cancel
Files of type:

Look in: BoxActivation

Files of type: Supported files (.in)

Figure 32 Box activation

6. To complete the activation, restart FPS-8.

Deactivating FPS-8

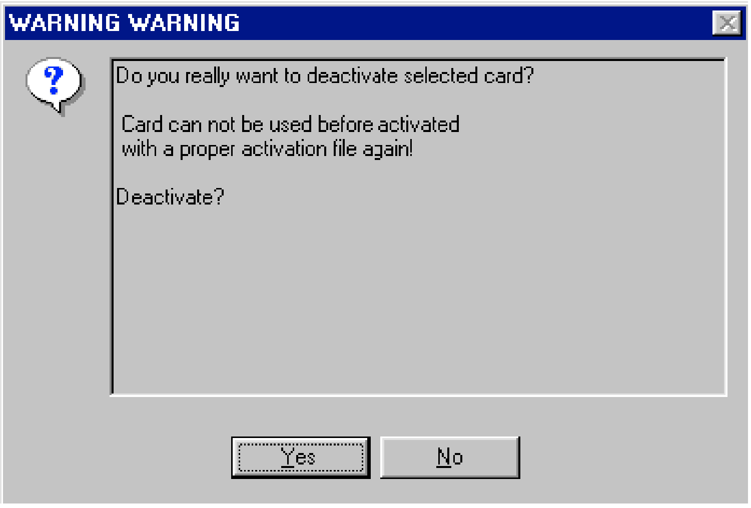
Context

If there is, for example, a need to send the FPS-8 box for repair, it must be deactivated first.

Steps

1. Start *Phoenix Service Software*.
2. Choose *Maintenance* → *Prommer Maintenance* .
3. In the *Prommer Maintenance* window, click Deactivate.

4. To confirm the deactivation, click Yes.



Do you really want to deactivate selected card?

Card can not be used before activated
with a proper activation file again!

Deactivate?

Figure 33 Deactivation warning

The box is deactivated.

5. To complete the deactivation, restart FPS-8.

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4 — Service Tools and Service Concepts

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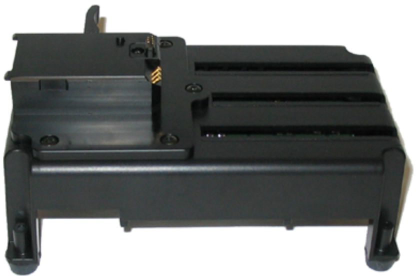
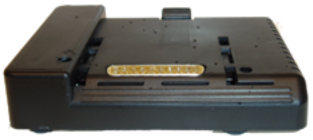
Service tools

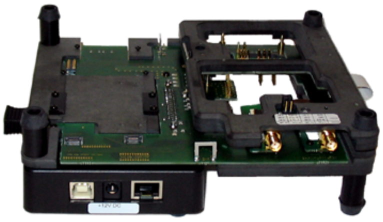
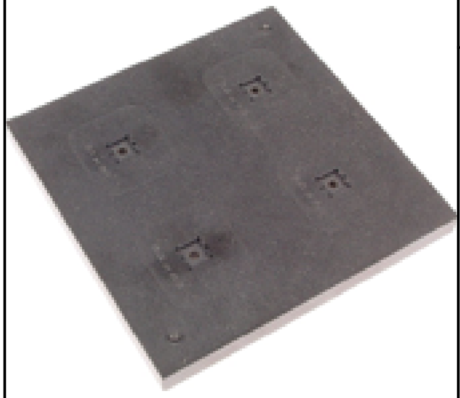
List of Service Tools

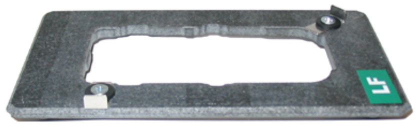
The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product , refer to various concepts.

	AC-33	Power supply	
	Universal power supply for FPS-10; included in the FPS-10 sales package.		
	AD-18FS	Flash adapter	
	AD-18FS has the following features: • Provides galvanic connection to terminal test pads • Provides standardized interface towards Control Unit • Provides RF connection using galvanic connector or coupler Multiplexing between USB and FBUS media, controlled by Vusb		
	CA-31D	USB cable	
	The CA-31D USB cable is used to connect FPS-10 or FPS-11 to a PC. It is included in the FPS-10 and FPS-11 sales packages.		

<table>
<tr><td rowspan="2"> </td><td>CA-35S</td><td>Power cable</td><td></td></tr>
<tr><td colspan="3">The power cable CA-35S is used to power up the interface adapter SS-46.</td></tr>
<tr><td rowspan="2"></td><td>CU-4</td><td>Control unit</td><td></td></tr>
<tr><td colspan="3">CU-4 is a general service tool used with a module jig and a flash adapter.
CU-4 requires an external 12 V power supply.
The unit has the following features:
• software controlled via USB
• EM calibration function
• Forwards FBUS/Flashbus traffic to/from terminal
• Forwards USB traffic to/from terminal
• software controlled BSI values
• regulated VBATT voltage
• 2 x USB2.0 connector (Hub)
• FBUS and USB connections supported</td></tr>
<tr><td rowspan="2"> </td><td>DKU-2</td><td>USB connectivity cable</td><td></td></tr>
<tr><td colspan="3">USB to Pop-Port^{TM} connector cable.</td></tr>
</table>

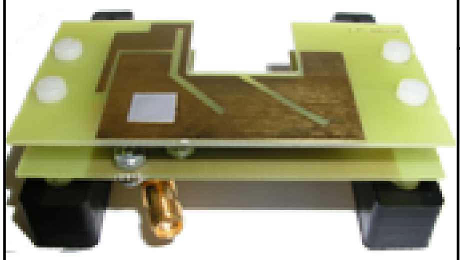
	FLS-4S	Flash device	
	FLS-4S is a dongle and flash device incorporated into one package, developed specifically for POS use.		
	FPS-10	Flash prommer	
	FPS-10 interfaces with: • PC • Control unit • Flash adapter • Smart card FPS-10 flash prommer features: • Flash functionality for BB5 terminals • Smart Card reader for SX-2 or SX-4 • USB traffic forwarding • USB to FBUS/Flashbus conversion • LAN to FBUS/Flashbus and USB conversion • Vusb output switchable by PC command FPS-10 sales package includes: • FPS-10 prommer • Power Supply with 5 country specific cords • USB cable		
	JBT-9	Bluetooth test and interface box (sales pack)	
	The JBT-9 test box is a generic device to perform Bluetooth bit error rate testing and doing cordless FBUS connection via Bluetooth. An ACP-8x charger is needed for BER testing and AXS-4 cable in case of cordless testing interface usage. • JBT-9 testbox • Installation and warranty information		

<table>
<tr><td rowspan="2"></td><td>MJ-47</td><td>Module jig</td><td></td></tr>
<tr><td colspan="3">MJ-47 is meant for component level troubleshooting.
The jig includes an RF interface for GSM, WCDMA and Bluetooth. In addition, it has the following features:
• Provides mechanical interface with the engine module
• Provides galvanic connection to all needed test pads in module
• Multiplexing between USB and FBUS media, controlled by Vusb
• UI test interface
• MMC interface
• Duplicated SIM connector
• Audio components: IHF, MIC, earpiece
• Connector for control unit
• Access for Pop-Port^{TM} system connector
Note: In the picture CU-4 is connected to MJ-47 . CU-4 is not part of the MJ-47 sales package and has to be ordered separately.</td></tr>
<tr><td rowspan="2"> </td><td>PCS-1</td><td>Power cable</td><td></td></tr>
<tr><td colspan="3">The PCS-1 power cable (DC) is used with a docking station, a module jig or a control unit to supply a controlled operating voltage.</td></tr>
<tr><td rowspan="2"> </td><td>PKD-1</td><td>SW security device</td><td></td></tr>
<tr><td colspan="3">SW security device is a piece of hardware enabling the use of the service software when connected to the parallel (LPT) port of the PC.
Without the device, it is not possible to use the service software.
Printer or any such device can be connected to the PC through the device if needed.</td></tr>
<tr><td rowspan="2"></td><td>RJ-56</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">RJ-56 is a rework jig used with ST-21.</td></tr>
</table>



RJ-74	Soldering jig	

RJ-74 is a soldering jig used for soldering and as a rework jig for the engine module.



SA-69	RF coupler	

SA-69 is an RF coupler for GSM RF testing. It is used together with a product-specific flash adapter.

The following tables show the coupler attenuation values:

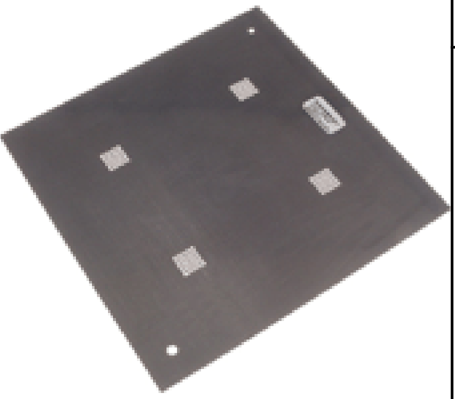
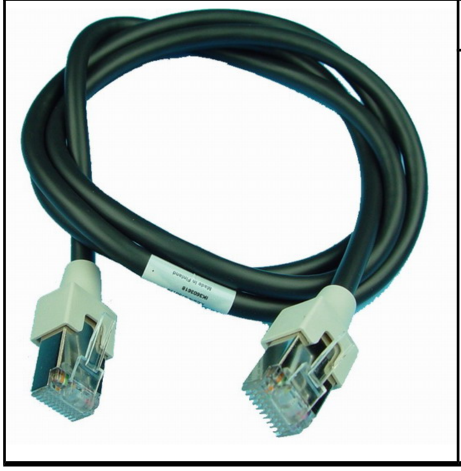
- **Table 8 Attenuations for RM-57**

GSM900 TX	Att. (dB)	GSM900 RX	Att. (dB)
880 MHz	4.3	925 MHz	3.4
897 MHz	3.8	942 MHz	3.3
915 MHz	3.5	960 MHz	3.5
GSM1800 TX	Att. (dB)	GSM1800 RX	Att. (dB)
1710 MHz	6.8	1805 MHz	6.1
1748 MHz	6.1	1843 MHz	6
1785 MHz	6.1	1880 MHz	6
GSM1900 TX	Att. (dB)	GSM1900 RX	Att. (dB)
1850 MHz	6	1930 MHz	6.3
1880 MHz	6	1960 MHz	6.6
1910 MHz	6.2	1990 MHz	6.8

- **Table 9 Attenuations for RM-58**

GSM850 TX	Att. (dB)	GSM850 RX	Att. (dB)
824 MHz	5.3	869 MHz	3.6
837 MHz	4.7	882 MHz	3.3
848 MHz	4.4	894 MHz	3.2
GSM1800 TX	Att. (dB)	GSM1800 RX	Att. (dB)
1710 MHz	6.2	1805 MHz	6.2
1748 MHz	6	1843 MHz	6.2
1785 MHz	6.2	1880 MHz	6.2
GSM1900 TX	Att. (dB)	GSM1900 RX	Att. (dB)
1850 MHz	6.2	1930 MHz	6.4
1880 MHz	6.2	1960 MHz	6.4
1910 MHz	6.3	1990 MHz	6.6

<table>
<tr><td rowspan="2"> </td><td>SPS-1</td><td>Soldering Paste Spreader</td><td></td></tr>
<tr><td colspan="3"></td></tr>
<tr><td rowspan="2"> </td><td>SPS-2</td><td>Soldering paste spreader</td><td></td></tr>
<tr><td colspan="3"></td></tr>
<tr><td rowspan="2"> </td><td>SRT-6</td><td>Opening tool</td><td></td></tr>
<tr><td colspan="3"></td></tr>
<tr><td rowspan="2"> </td><td>SS-15</td><td>Camera removal tool</td><td></td></tr>
<tr><td colspan="3">The camera removal tool SS-15 is used to remove/attach the camera module from/to the socket on the phone PWB.</td></tr>
<tr><td rowspan="2"> </td><td>SS-46</td><td>Interface adapter</td><td></td></tr>
<tr><td colspan="3">SS-46 acts as an interface adapter between the product-specific flash adapter and FPS-10.</td></tr>
</table>

	SS-68	Antenna cover opening tool	
	SS-68 is a tool for removing the antenna cover.		
	ST-21	Rework stencil	
	ST-21 is a rework stencil used with rework jig RJ-56.		
	SX-4	Smart card	
	SX-4 is a BB5 security device used to protect critical features in tuning and testing. SX-4 is also needed together with FPS-10 when DCT-4 phones are flashed.		
	XCS-4	Modular cable	
	XCS-4 is a shielded (one specially shielded conductor) modular cable for flashing and service purposes.		

	XRS-6	RF cable	
	The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment. SMA to N-Connector ca. 610mm. Attenuation for: • GSM850/900: 0.3+-0.1 dB • GSM1800/1900: 0.5+-0.1 dB • WLAN: 0.6+-0.1dB		

Service concepts

Flash concept with FPS-10

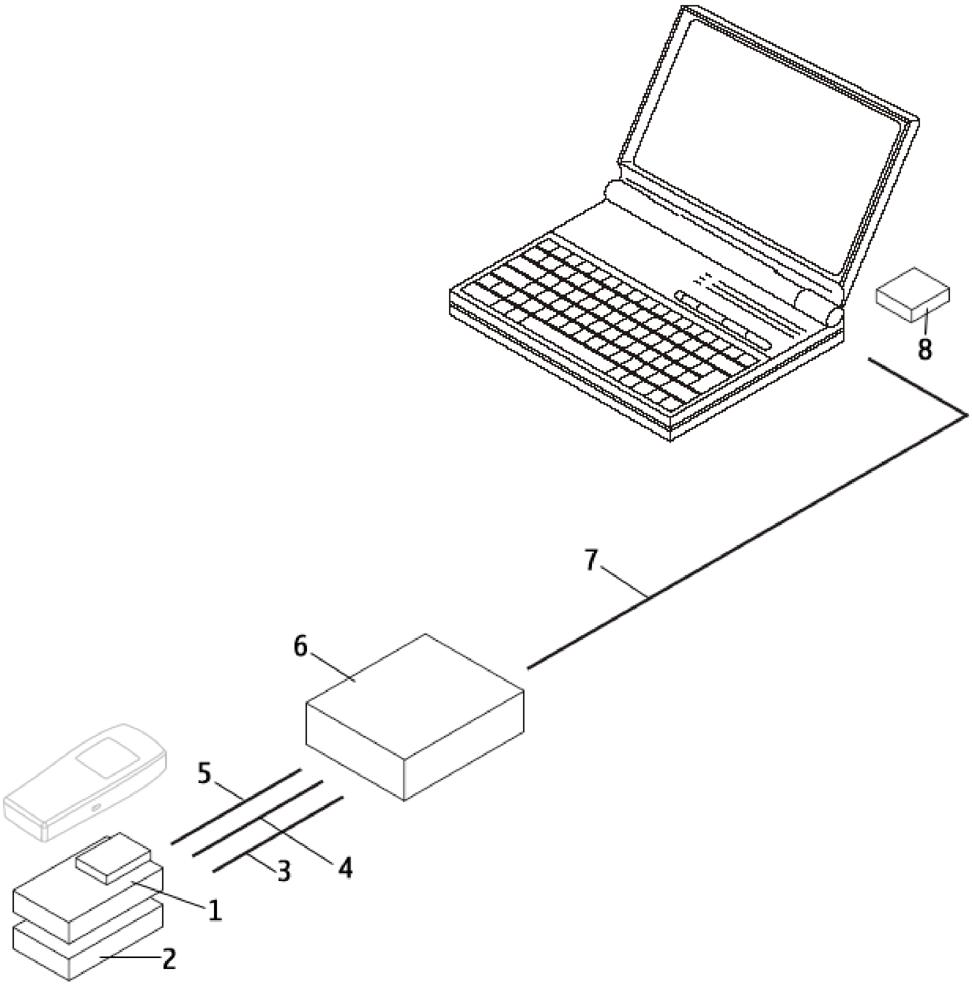


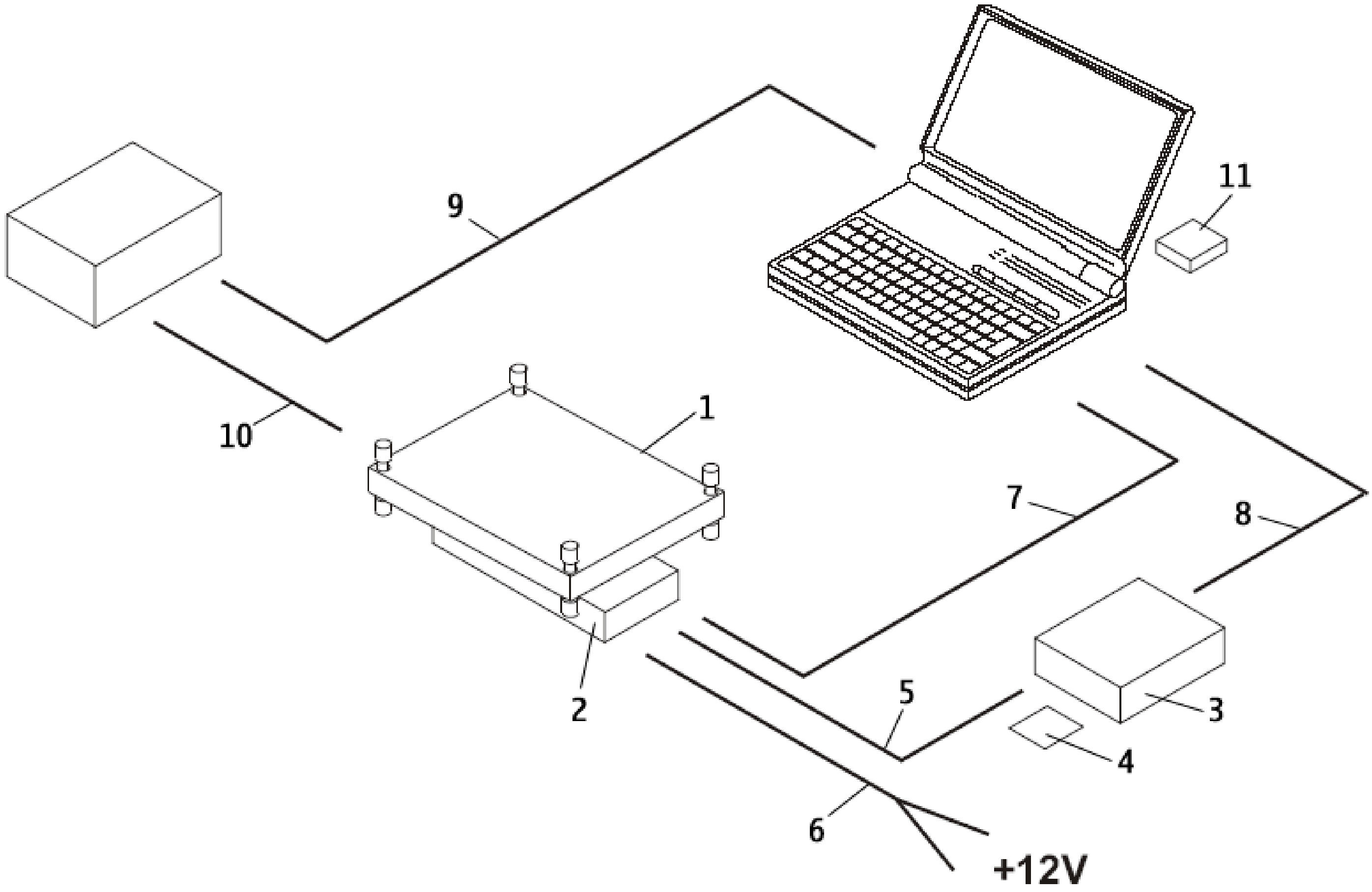
Figure 34 Basic flash concept with FPS-10

Note: FPS-8 concept can also be used for flashing.

Item	Type	Description
1	AD-18FS	Flash adapter

Item	Type	Description
2	SS-46	Interface adapter
3	CA-35S	Power cable
4	XCS-4	Modular cable
5	CA-31D	Standard USB A-B cable
6	FPS-10	Flash prommer box
7	CA-31D	Standard USB A-B cable
8	PKD-1	SW security device

MJ-47 module jig concept



Legend

Module jig concept is meant for BB / RF testing + tuning and for flashing purposes.

Figure 35 MJ-47 module jig service concept

Item	Type	Description
1	MJ-47	Module jig
2	CU-4	Control unit
3	FPS-10	Flash prommer box

Item	Type	Description
4	SX-4	Smart card
5	XCS-4	Modular cable
6	PCS-1	DC power cable
7	CA-31D	Standard USB A-B cable
8	CA-31D	Standard USB A-B cable
9		GPIB control cable
10	XRS-6	RF cable
11	PKD-1	SW security device

POS (Point of Sale) flash concept

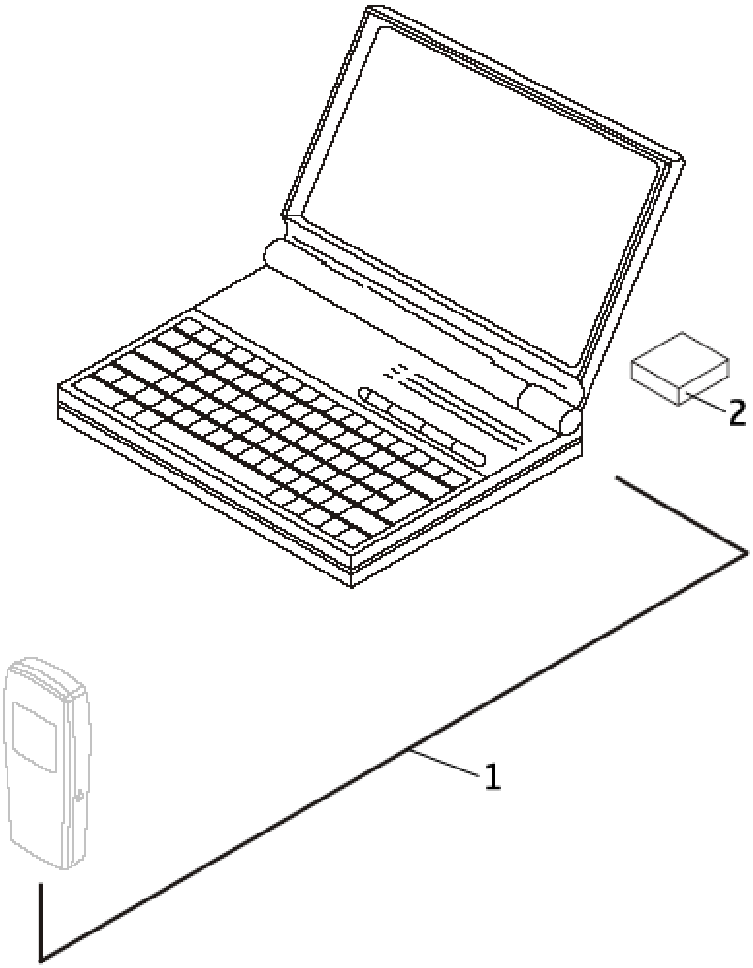


Figure 36 POS flash concept

Item	Type	Description
1	DKU-2	USB connectivity cable
2	FLS-4S	POS flash device

Service concept for RF/BB testing and tuning

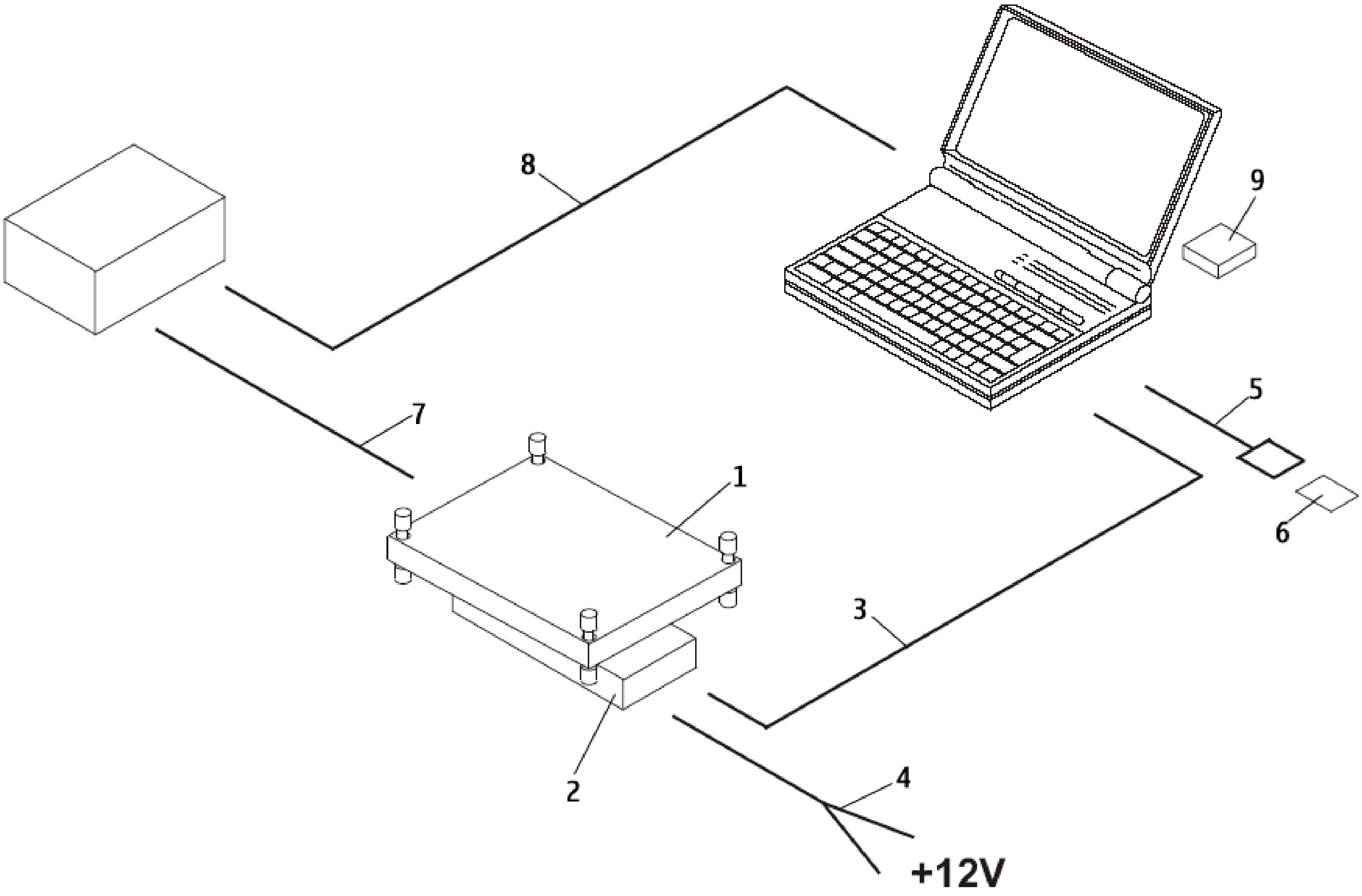


Figure 37 Service concept for RF/BB testing and tuning

Item	Type	Description
1	MJ-47	Module jig
2	CU-4	Control unit
3	CA-31D	Standard USB A-B cable
4	PCS-1	DC power cable
5	CA-31D	Standard USB A-B cable + smart card reader
6	SX-4	Smart card
7	XRS-6	RF cable
8		GPIB control cable
9	PKD-1	SW security device

CU-4 flash concept with FPS-10

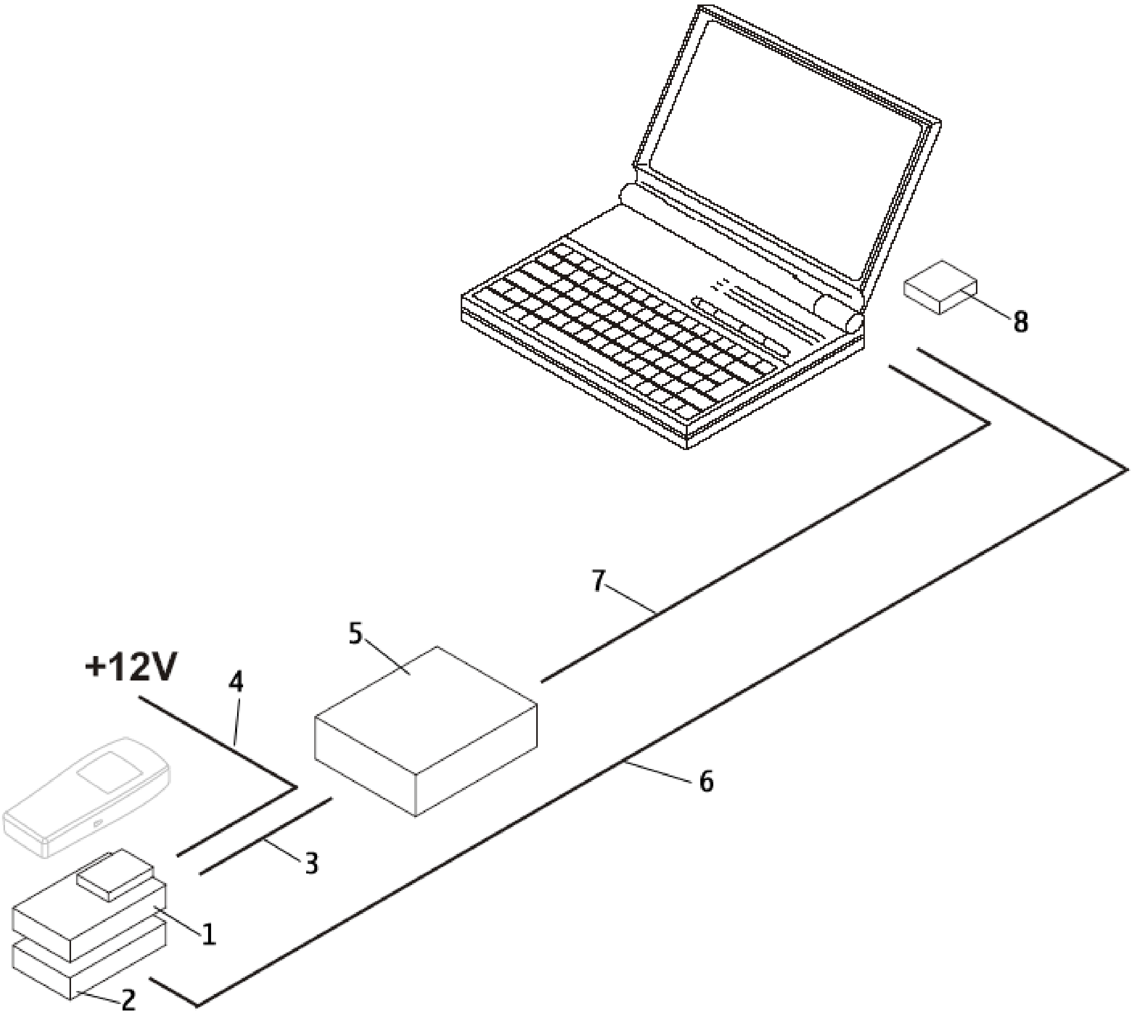


Figure 38 CU-4 flash concept with FPS-10

Note: FPS-8 concept can also be used for flashing.

Item	Type	Description
1	AD-18FS	Flash adapter
2	CU-4	Control unit
3	XCS-4	Modular cable
4	PCS-1	Power cable
5	FPS-10	Flash prommer box
6	CA-31D	Standard USB A-B cable
7	CA-31D	Standard USB A-B cable
8	PKD-1	SW security device

RF testing and BB testing/tuning concept

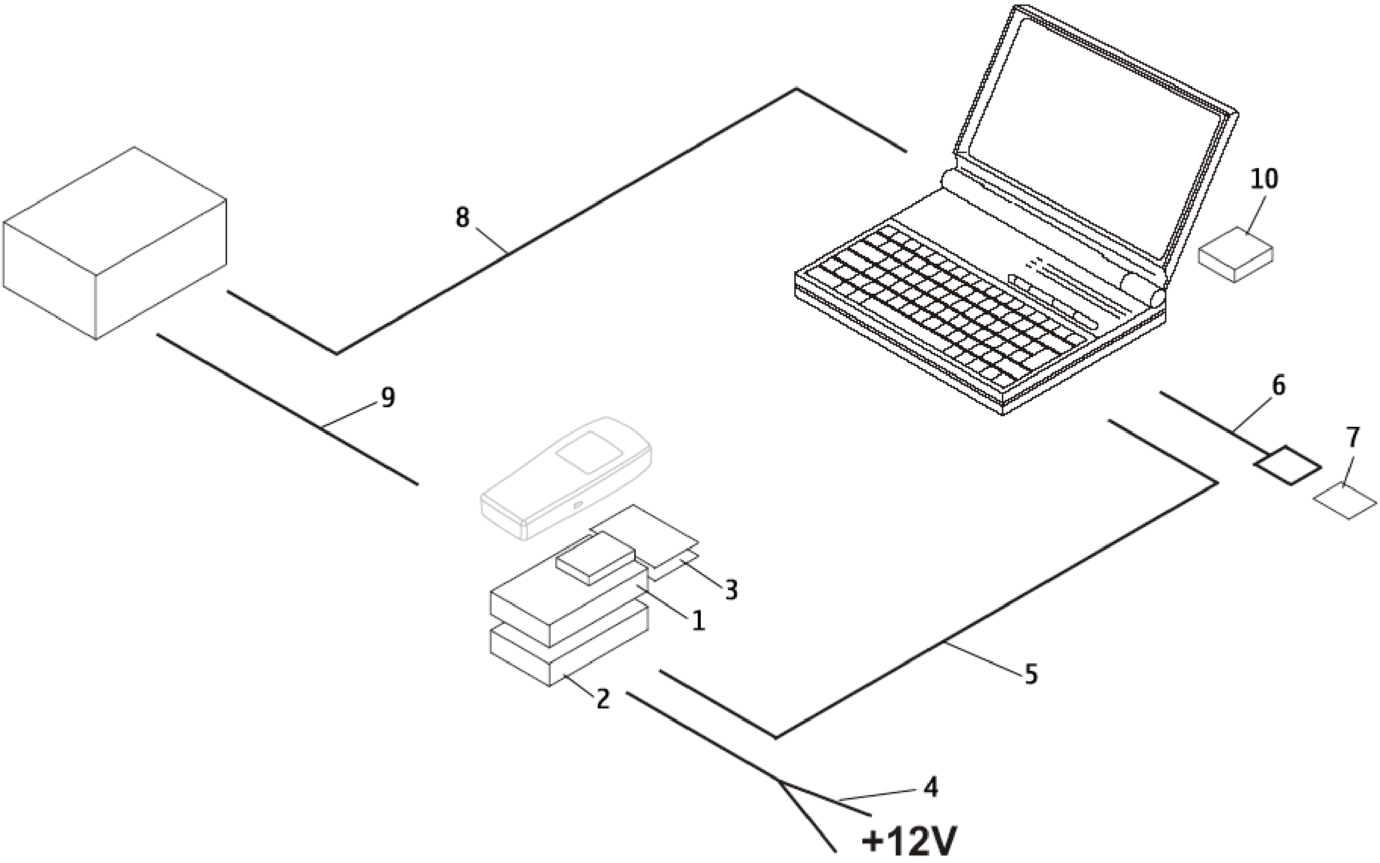


Figure 39 RF testing and BB testing/tuning concept

Item	Type	Description
1	AD-18FS	Flash adapter
2	CU-4	Control unit
3	SA-69	RF coupler
4	PCS-1	Power cable
5	CA-31D	Standard USB A-B cable
6	CA-31D	Standard USB A-B cable + smart card reader
7	SX-4	Smart card
8		GPIB control cable
9	XRS-6	RF cable
10	PKD-1	SW security device

LAN connection flash concept

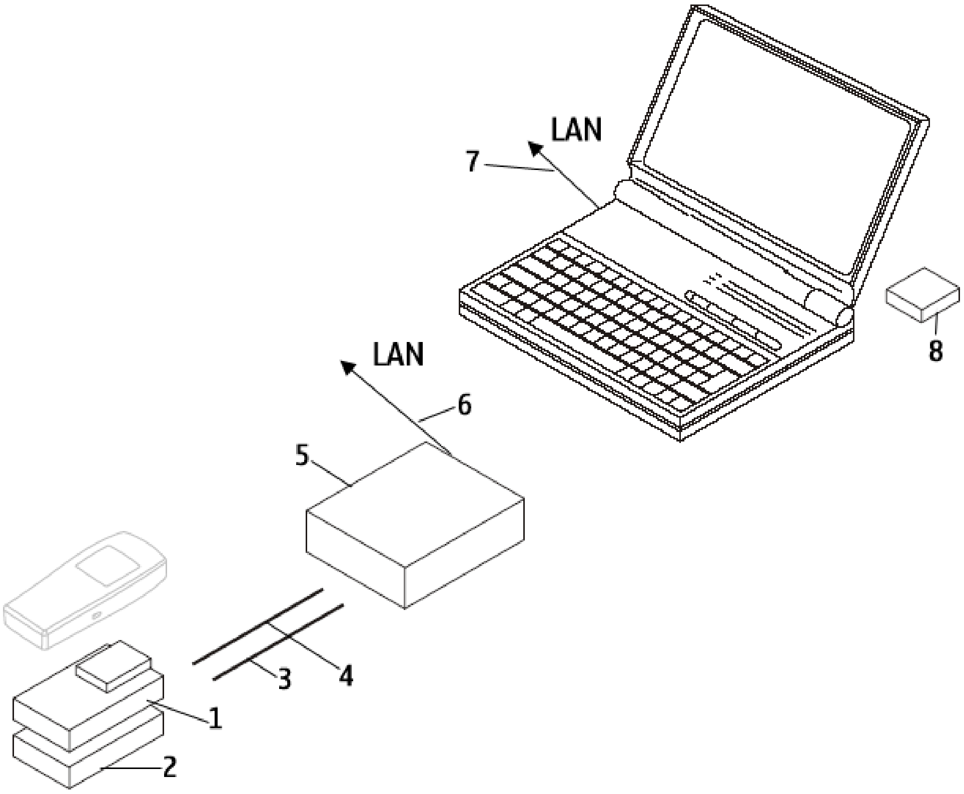


Figure 40 LAN connection flash concept

Item	Type	Description
1	AD-18FS	Flash adapter
2	SS-46	Interface adapter
3	CA-35S	Power cable
4	XCS-4	Modular cable
5	FPS-10	Flash prommer box
6		LAN cable
7		LAN cable
8	PKD-1	SW security device

5 — Disassembly/Reassembly Instructions

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Table of Contents

Disassembly / reassembly instructions....5–5
Removing shielding lids....5–14

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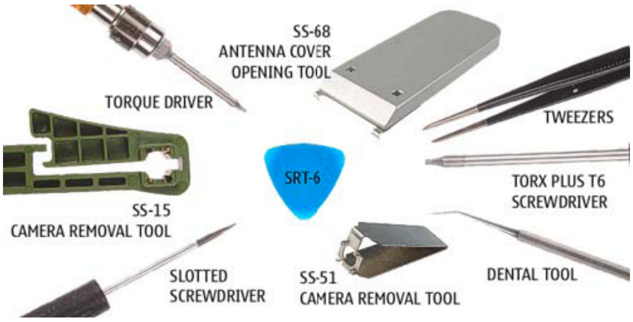
Disassembly / reassembly instructions

Before you begin

The following picture shows the tools required in the disassembly/reassembly procedure:


SS-68
ANTENNA COVER
OPENING TOOL
TORQUE DRIVER
TWEEZERS
SRT-6
TORX PLUS T6
SCREWDRIVER
SS-15
CAMERA REMOVAL TOOL
SLOTTED
SCREWDRIVER
SS-51
CAMERA REMOVAL TOOL
DENTAL TOOL

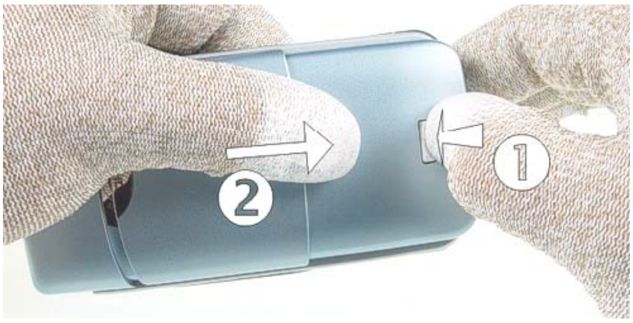
Note: Reassembly takes place in the reverse order.

Note the reassembly-specific instructions in steps: **6.**, **8.**, **17.**, **28.**, **30.**, **34.**

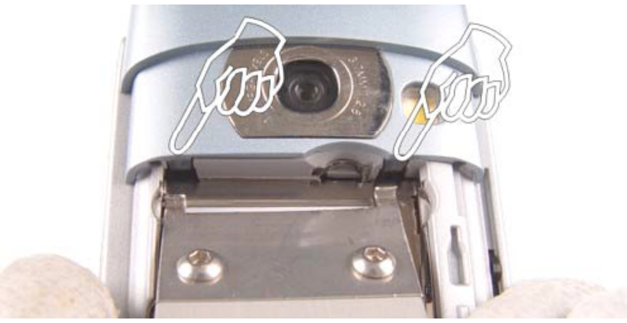
Steps

1. Protect the window with a film.

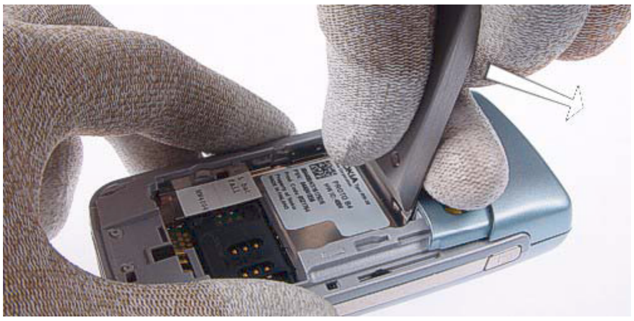
2. Press the release button and remove the **B-Cover**.



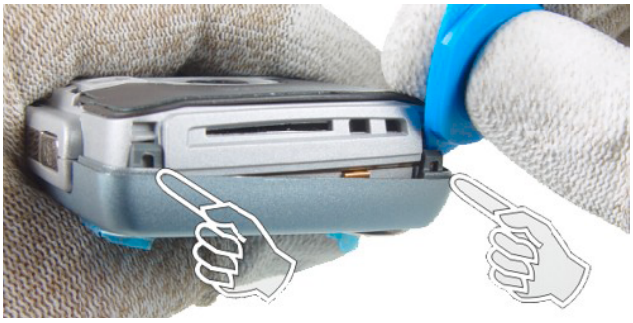
3. Place SS-68 into the openings.



4. Carefully pull down the **Antenna Cover**.

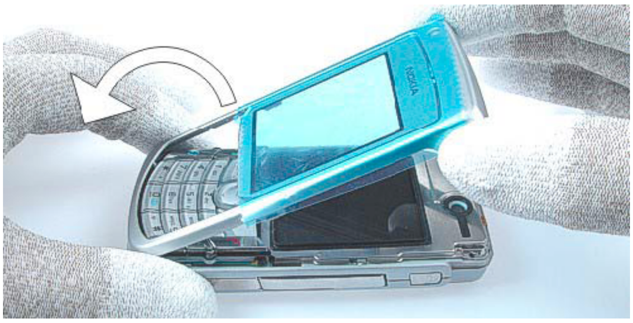


5. Use SRT-6 to release both clips of the A-Cover.



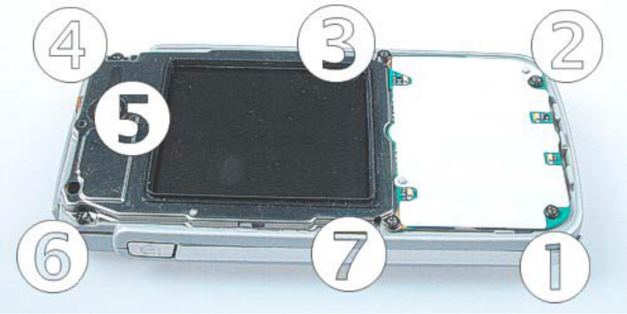
6. Remove the **A-Cover** as shown in the picture.

   Note: When reassembling the device, replace the A-Cover with a new one if necessary.

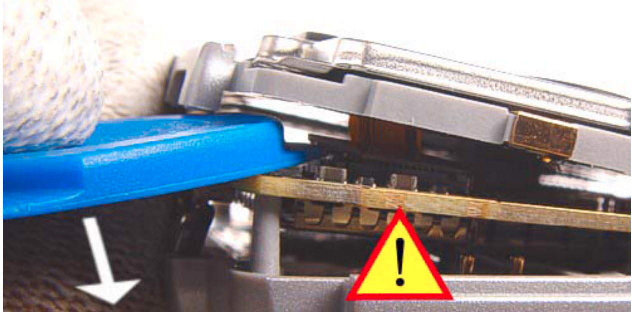


7. Remove the **Keymat**.

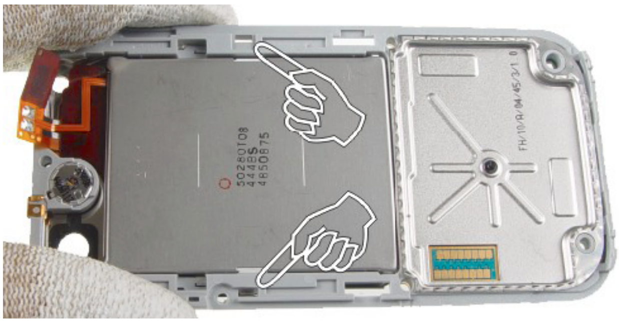
8. Unscrew the seven Torx Plus® size 6 screws in the shown order. For reassembly, use the reverse order and a torque driver with a torque of 25Ncm.



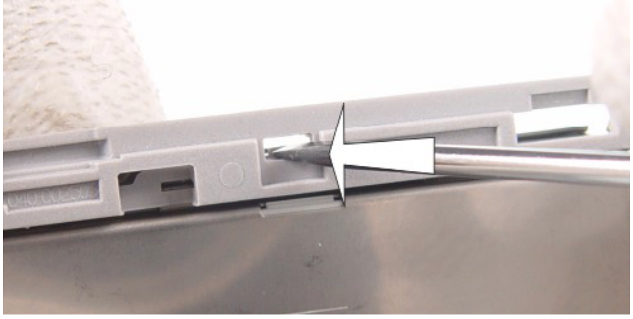
9. Carefully open the display connector with SRT-6; avoid damaging the surrounding components.



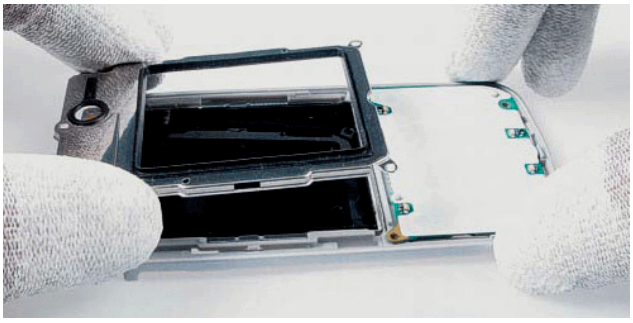
10. The **Display Shield** is locked to the **UI Frame** at the places shown.



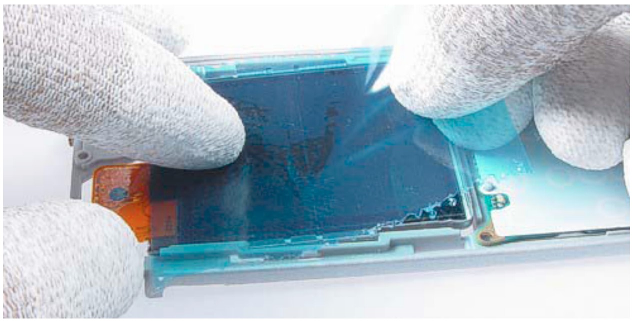
Release the **Display Shield** with a slotted screwdriver.



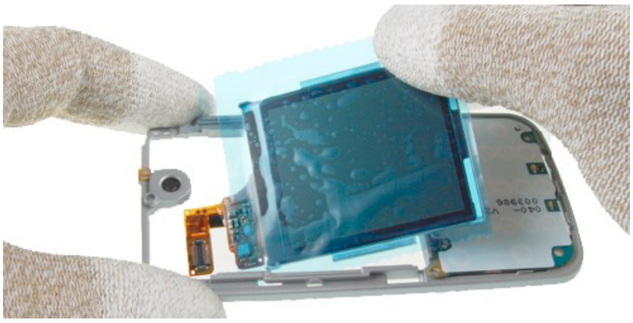
11. Remove the **Display Shield.**



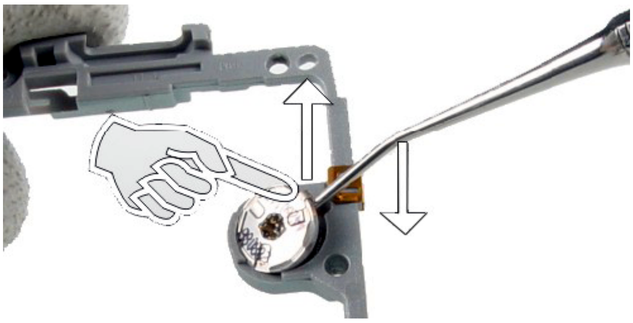
12. Protect the **Display** with a film.



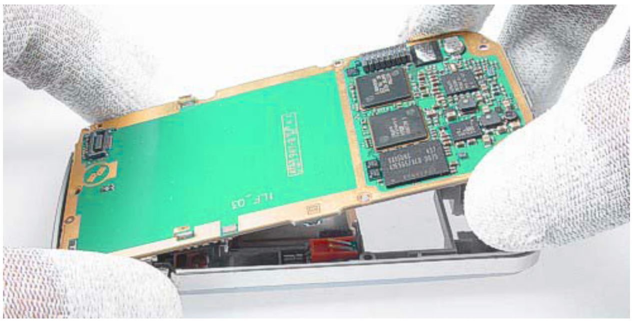
13. Remove the **Display**.



14. Use a dental tool as a lever to remove the **Earpiece**.

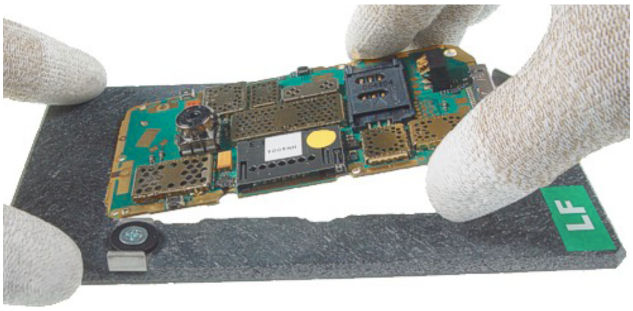


15. Remove the **Engine Module**.

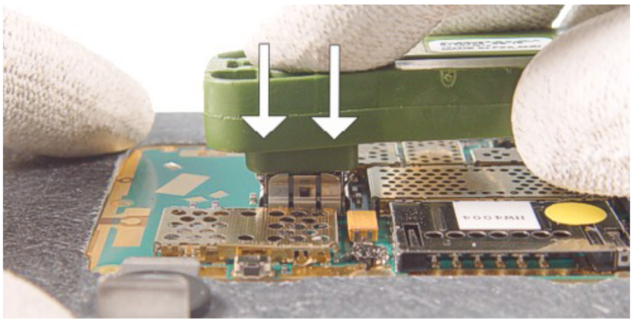


16. Place the **Engine Module** on the soldering jig.

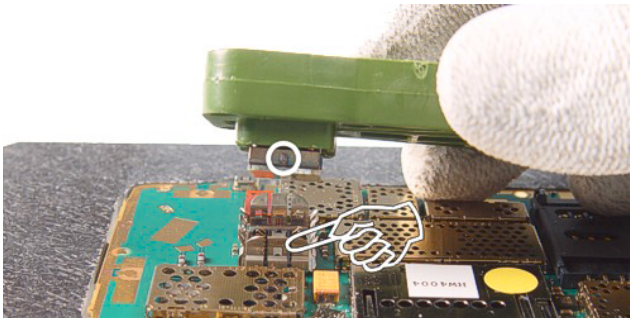
    Note: Always use the product-specific soldering jig as a support when working on the **Engine Module**.



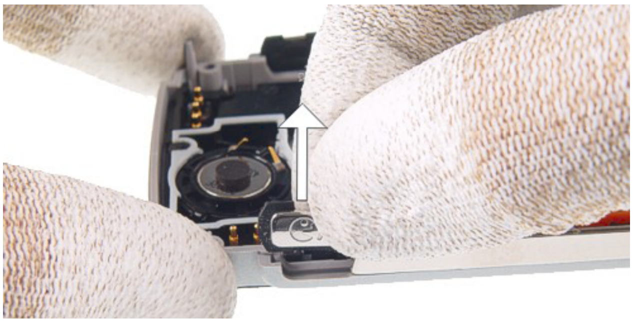
17. Use SS-15 to remove the **Camera Module 1.3MP**.



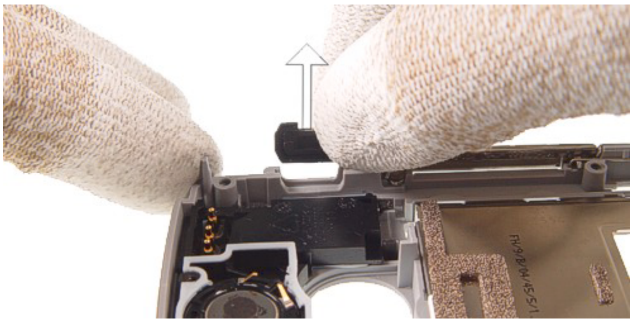
Note: Note the camera guide pins when reassembling and use the opposite side of the SS-15 tool.



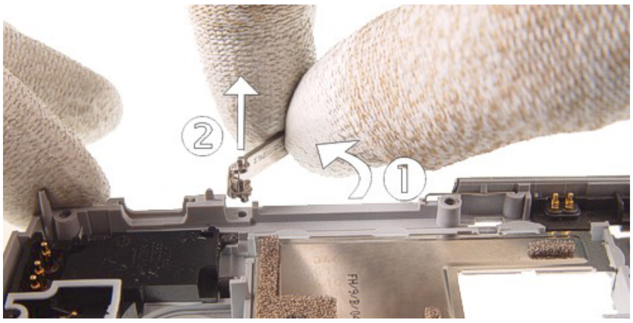
18. Remove the **Voice Key**.



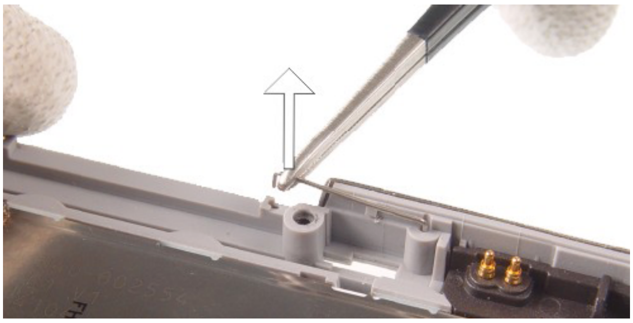
19. Remove the **Power Key**.



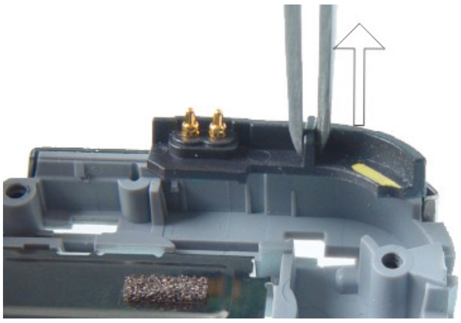
20. Open the **MMC Door** and remove it from its holder.



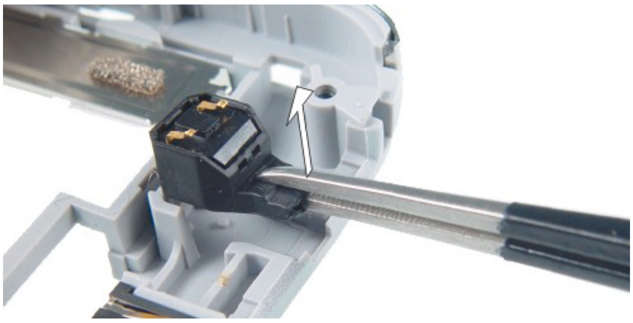
21. Use tweezers to remove the **MMC Door Spring**.



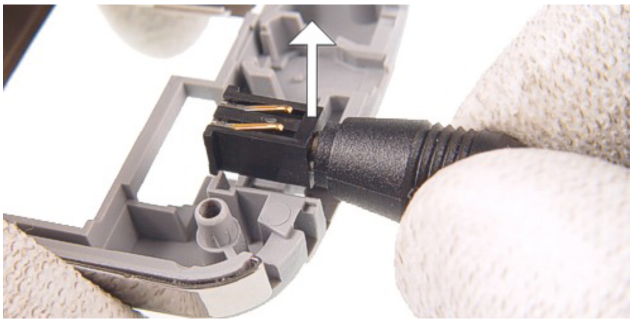
22. Remove the **Bluetooth Antenna**.



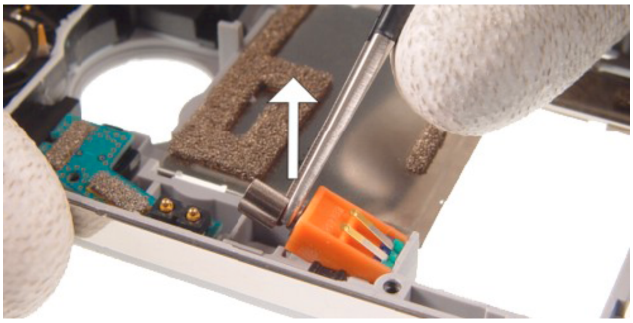
23. Remove the **Microphone**.



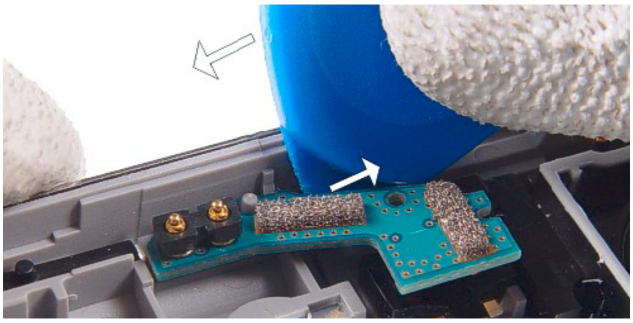
24. Use the DC plug to remove the **DC Jack**.



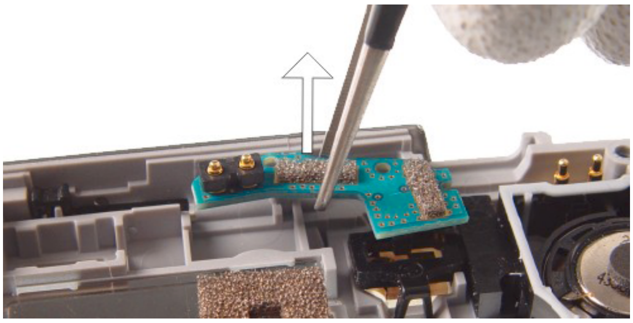
25. Use tweezers to remove the **Vibra Motor**.



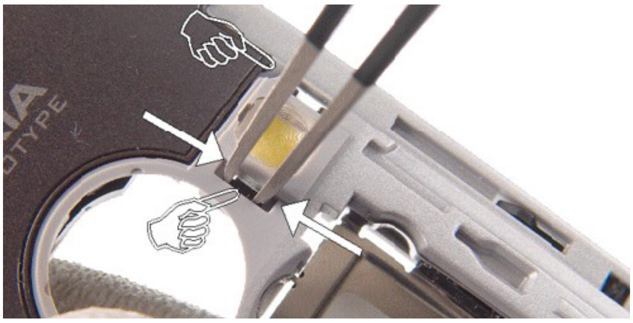
26. Use SRT-6 to unlock the **LED Flash Connector**.



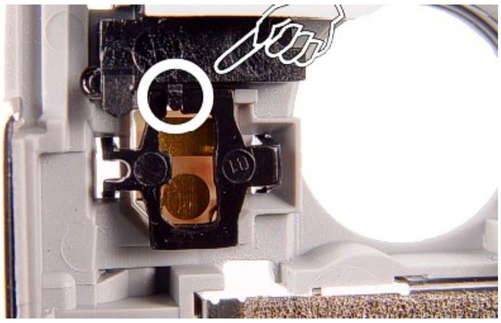
27. Use tweezers to remove the **LED Flash Connector**.



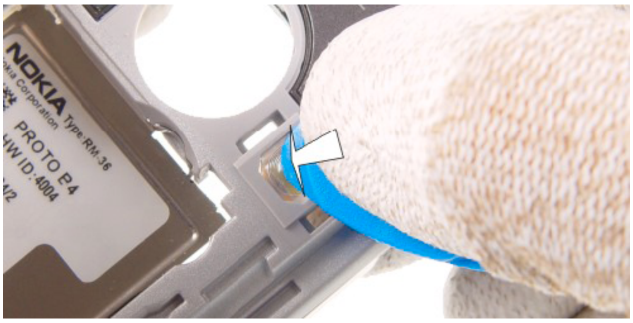
28. Use tweezers to unlock the snaps of the **LED Flash Holder**.



Note: Note the correct position of the **LED Flash Holder** when reassembling.

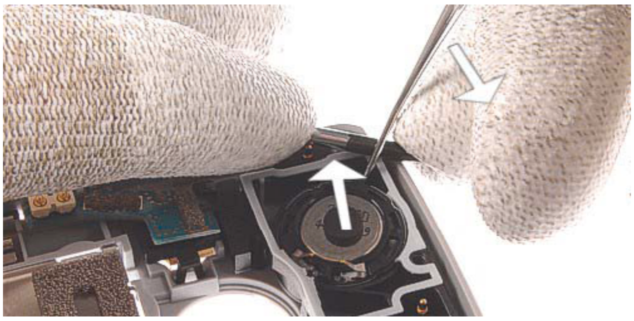


29. Use SRT-6 to push out the **LED Flash**.

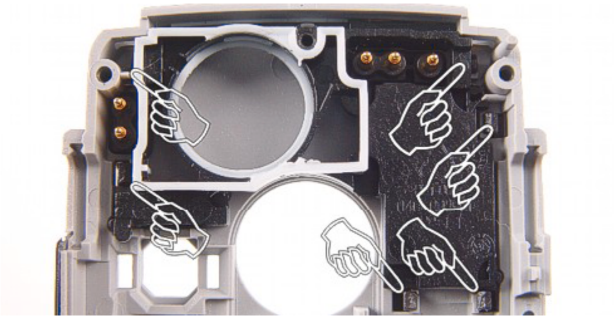


30. Use a screwdriver as a base to protect the Gasket. Then use the dental tool as a lever to remove the **IHF Speaker**.

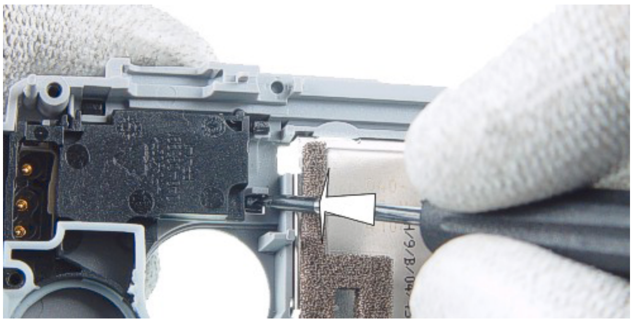
    When reassembling the IHF Speaker, press it firmly as far as it goes.



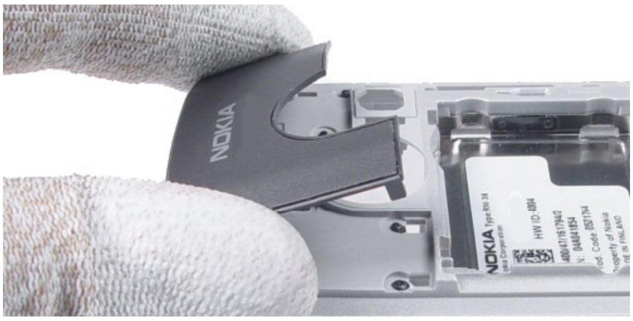
31. The **Antenna Assy** is attached with four snaps to the **Chassis Assy**.



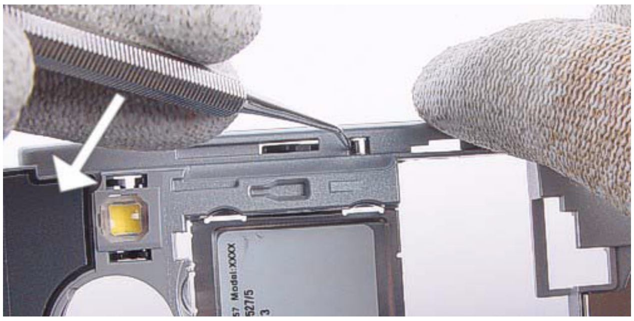
Carefully unlock the snaps with a slotted screwdriver.



32. Remove the **Antenna Assy**.

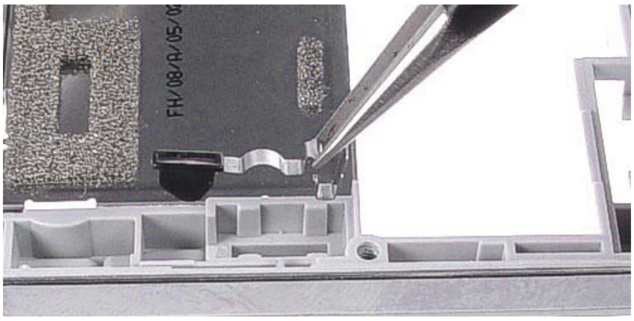


33. Push out the **Slide Sensor** with a dental tool.



34. Remove the **Slide Sensor**.

    Note: Note the right position when reassembling.

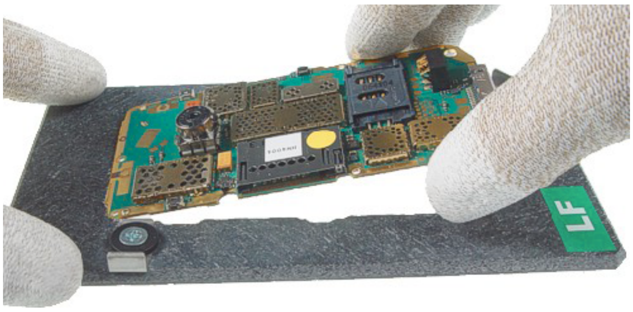


Removing shielding lids

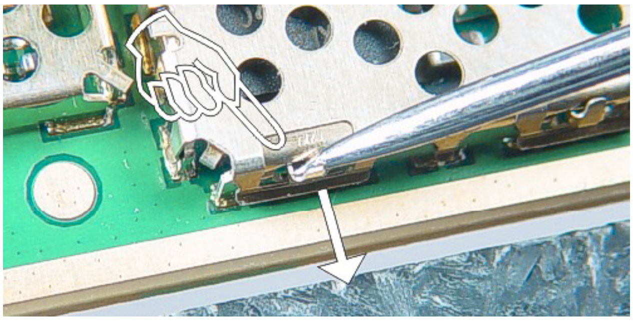
Steps

1. Place the Engine Module on the soldering jig.

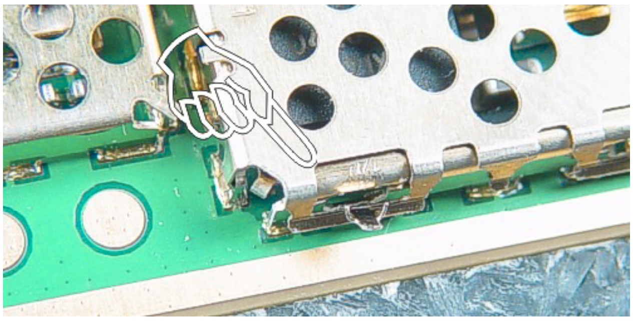
    Note: Always use the soldering jig as a support when working on the **Engine Module**.



2. Open the clips of the lids with a dental tool.

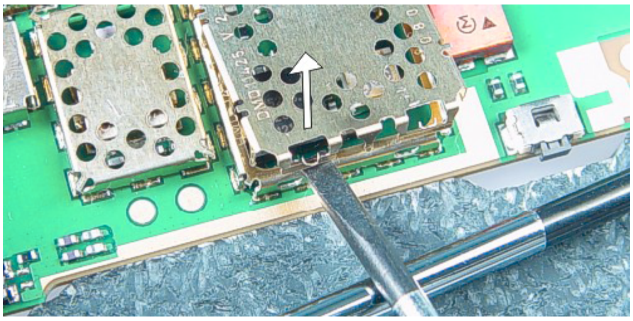


3. If all clips of the lid are in the position shown, you can remove the lid.



4. Use a slotted screwdriver as a lever to lift the **Shielding Lids**.

   Note: When reassembling, always use new **Shielding Lids**.



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6 — BB Troubleshooting and Manual Tuning Guide

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Baseband troubleshooting

Context

This section is intended to be a guide for localising and repairing electrical faults. The fault repairing is divided into troubleshooting paths. The following main troubleshooting tree describes the different baseband troubleshooting paths to be followed in fault situations.

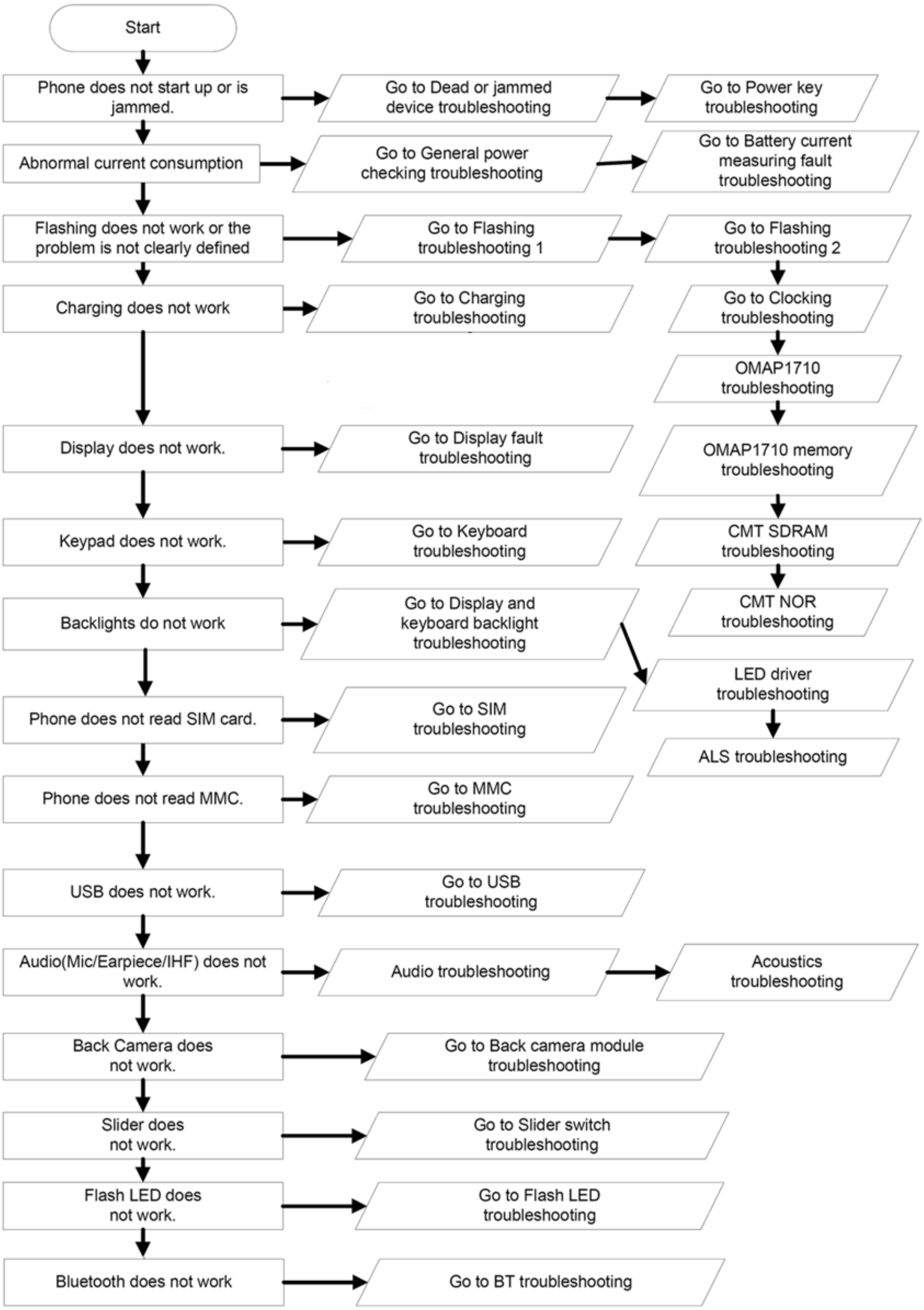
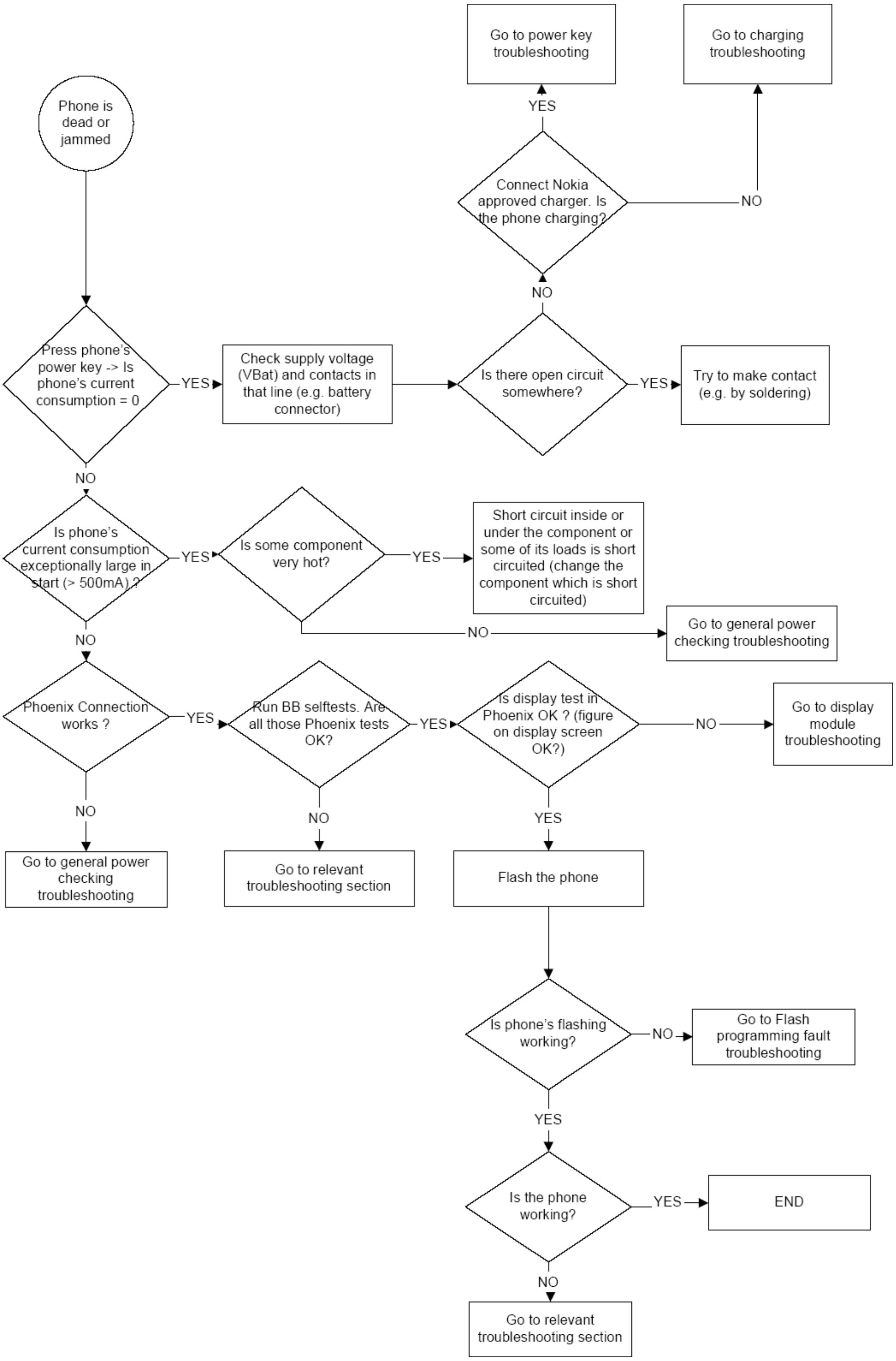
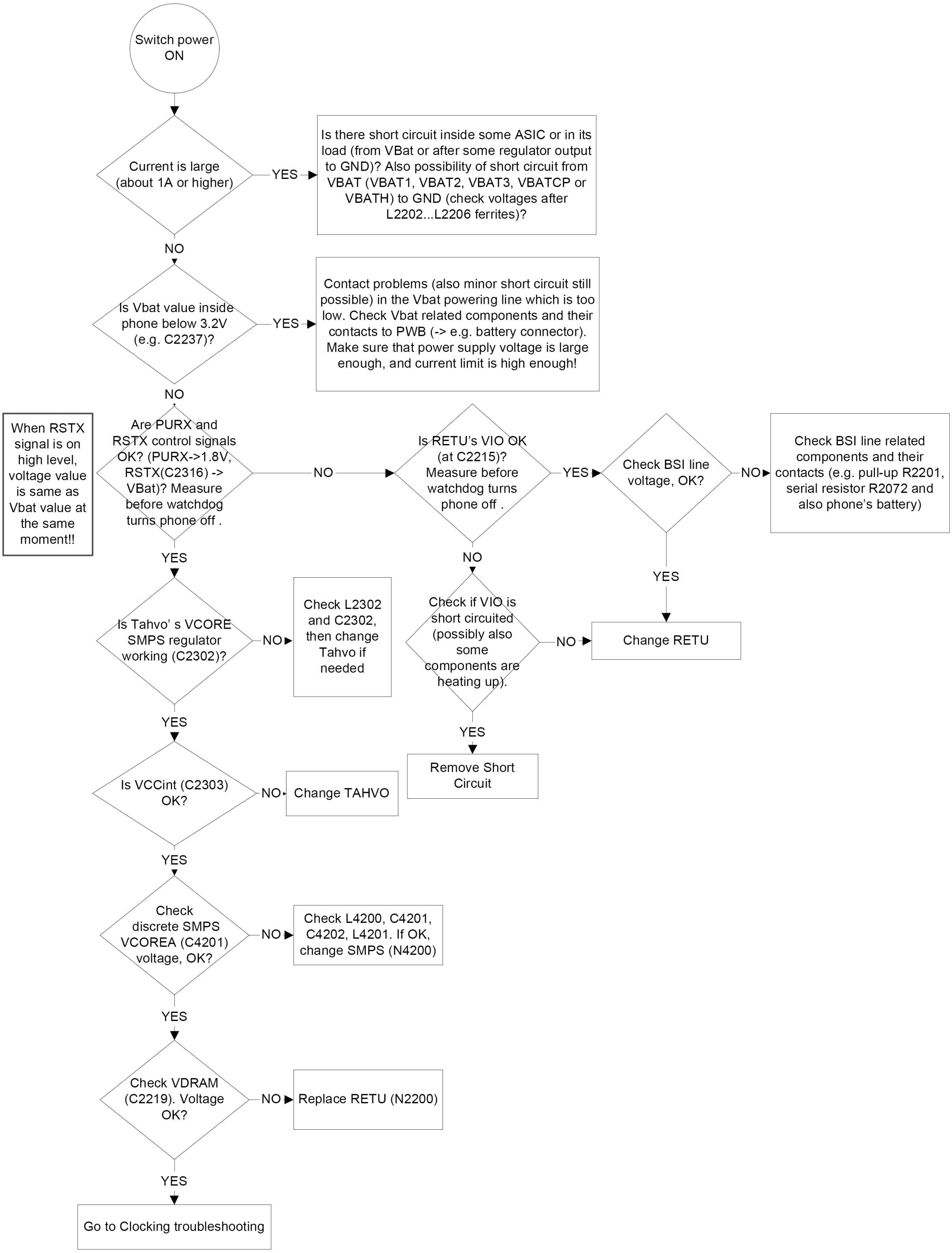

Start
Phone does not start up or is jammed.
Go to Dead or jammed device troubleshooting
Go to Power key troubleshooting
Abnormal current consumption
Go to General power checking troubleshooting
Go to Battery current measuring fault troubleshooting
Flashing does not work or the problem is not clearly defined
Go to Flashing troubleshooting 1
Go to Flashing troubleshooting 2
Charging does not work
Go to Charging troubleshooting
Go to Clocking troubleshooting
OMAP1710 troubleshooting
Display does not work.
Go to Display fault troubleshooting
OMAP1710 memory troubleshooting
Keypad does not work.
Go to Keyboard troubleshooting
CMT SDRAM troubleshooting
Backlights do not work
Go to Display and keyboard backlight troubleshooting
CMT NOR troubleshooting
LED driver troubleshooting
Phone does not read SIM card.
Go to SIM troubleshooting
ALS troubleshooting
Phone does not read MMC.
Go to MMC troubleshooting
USB does not work.
Go to USB troubleshooting
Audio(Mic/Earpiece/IHF) does not work.
Audio troubleshooting
Acoustics troubleshooting
Back Camera does not work.
Go to Back camera module troubleshooting
Slider does not work.
Go to Slider switch troubleshooting
Flash LED does not work.
Go to Flash LED troubleshooting
Bluetooth does not work
Go to BT troubleshooting

Figure 41 Main troubleshooting tree

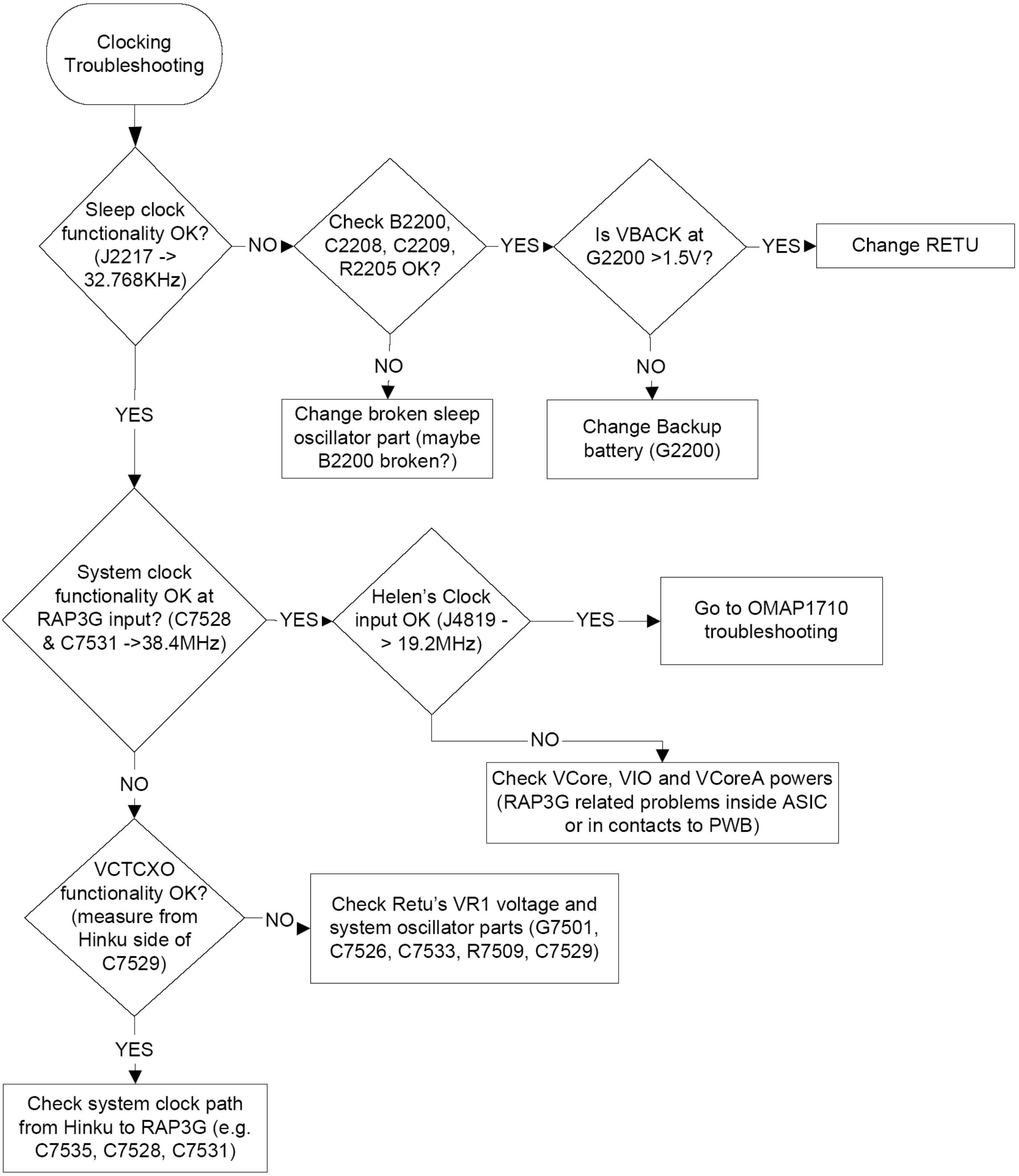
Dead or jammed device troubleshooting


Phone is dead or jammed
Press phone's power key -> Is phone's current consumption = 0
YES
Check supply voltage (VBat) and contacts in that line (e.g. battery connector)
Is there open circuit somewhere?
YES
Try to make contact (e.g. by soldering)
NO
Connect Nokia approved charger. Is the phone charging?
YES
Go to power key troubleshooting
NO
Go to charging troubleshooting
NO
Is phone's current consumption exceptionally large in start (> 500mA) ?
YES
Is some component very hot?
YES
Short circuit inside or under the component or some of its loads is short circuited (change the component which is short circuited)
NO
Go to general power checking troubleshooting
NO
Phoenix Connection works ?
NO
Go to general power checking troubleshooting
YES
Run BB selftests. Are all those Phoenix tests OK?
NO
Go to relevant troubleshooting section
YES
Is display test in Phoenix OK ? (figure on display screen OK?)
NO
Go to display module troubleshooting
YES
Flash the phone
Is phone's flashing working?
NO
Go to Flash programming fault troubleshooting
YES
Is the phone working?
YES
END
NO
Go to relevant troubleshooting section

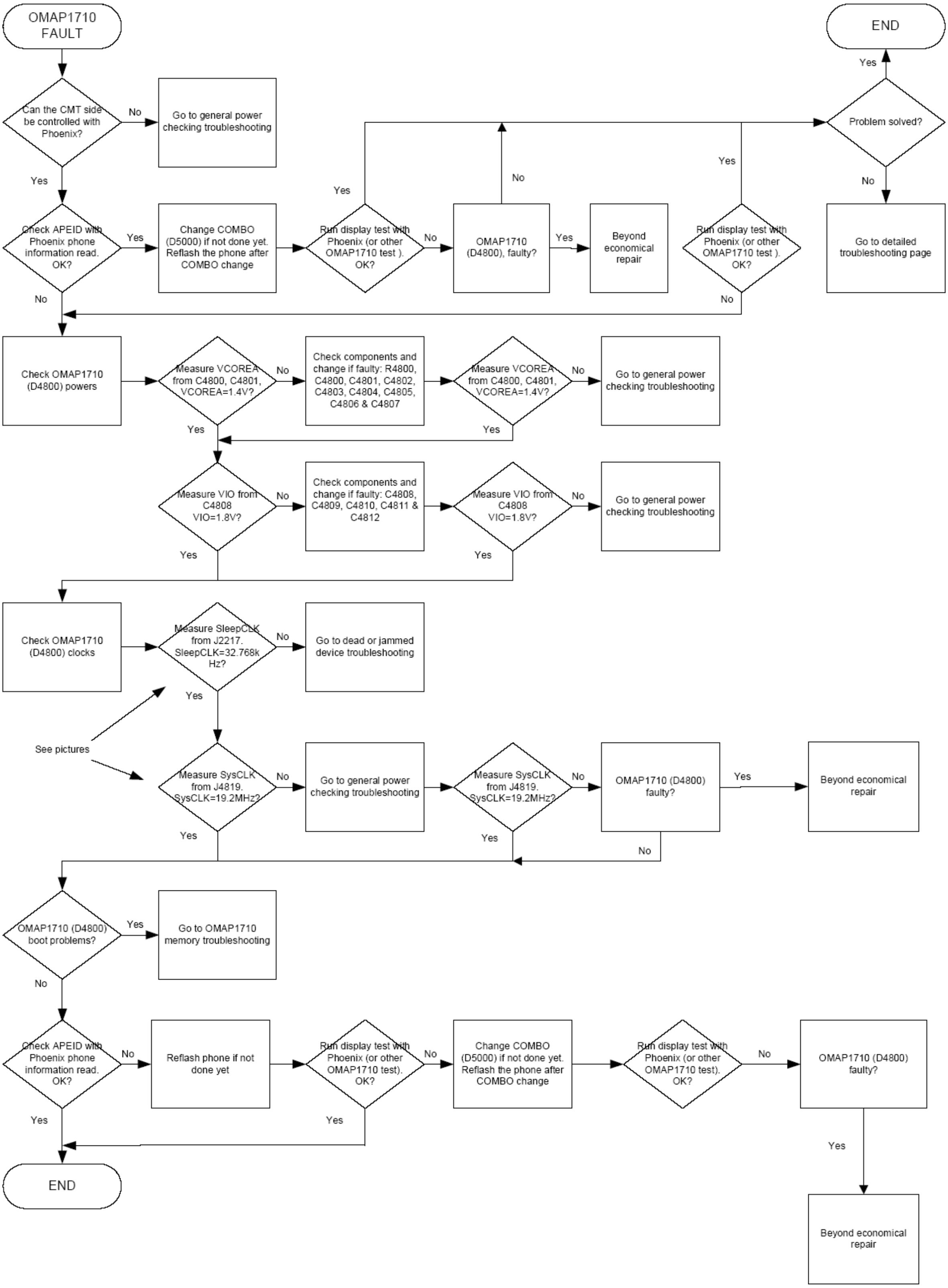
General power checking troubleshooting


Switch power ON
Current is large (about 1A or higher)
YES
Is there short circuit inside some ASIC or in its load (from VBat or after some regulator output to GND)? Also possibility of short circuit from VBAT (VBAT1, VBAT2, VBAT3, VBATCP or VBATH) to GND (check voltages after L2202...L2206 ferrites)?
NO
Is Vbat value inside phone below 3.2V (e.g. C2237)?
YES
Contact problems (also minor short circuit still possible) in the Vbat powering line which is too low. Check Vbat related components and their contacts to PWB (-> e.g. battery connector). Make sure that power supply voltage is large enough, and current limit is high enough!
NO
When RSTX signal is on high level, voltage value is same as Vbat value at the same moment!!
Are PURX and RSTX control signals OK? (PURX->1.8V, RSTX(C2316) -> VBat)? Measure before watchdog turns phone off .
NO
Is RETU's VIO OK (at C2215)? Measure before watchdog turns phone off .
YES
Check BSI line voltage, OK?
NO
Check BSI line related components and their contacts (e.g. pull-up R2201, serial resistor R2072 and also phone's battery)
YES
Change RETU
NO
Check if VIO is short circuited (possibly also some components are heating up).
NO
YES
Remove Short Circuit
YES
Is Tahvo' s VCORE SMPS regulator working (C2302)?
NO
Check L2302 and C2302, then change Tahvo if needed
YES
Is VCCint (C2303) OK?
NO
Change TAHVO
YES
Check discrete SMPS VCOREA (C4201) voltage, OK?
NO
Check L4200, C4201, C4202, L4201. If OK, change SMPS (N4200)
YES
Check VDRAM (C2219). Voltage OK?
NO
Replace RETU (N2200)
YES
Go to Clocking troubleshooting

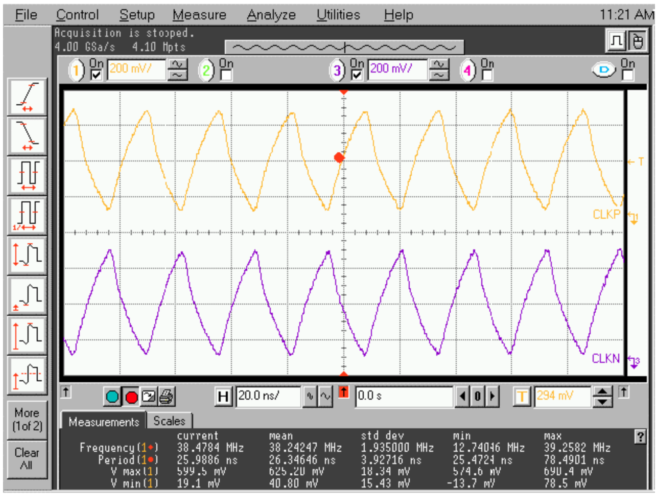
Clocking troubleshooting


Clocking Troubleshooting
Sleep clock functionality OK? (J2217 -> 32.768KHz)
NO
Check B2200, C2208, C2209, R2205 OK?
YES
Is VBACK at G2200 >1.5V?
YES
Change RETU
NO
Change broken sleep oscillator part (maybe B2200 broken?)
NO
Change Backup battery (G2200)
YES
System clock functionality OK at RAP3G input? (C7528 & C7531 ->38.4MHz)
YES
Helen's Clock input OK (J4819 -> 19.2MHz)
YES
Go to OMAP1710 troubleshooting
NO
Check VCore, VIO and VCoreA powers (RAP3G related problems inside ASIC or in contacts to PWB)
NO
VCTCXO functionality OK? (measure from Hinku side of C7529)
NO
Check Retu's VR1 voltage and system oscillator parts (G7501, C7526, C7533, R7509, C7529)
YES
Check system clock path from Hinku to RAP3G (e.g. C7535, C7528, C7531)

OMAP1710 troubleshooting


OMAP1710 FAULT
Can the CMT side be controlled with Phoenix?
No
Go to general power checking troubleshooting
Yes
Check APEID with Phoenix phone information read. OK?
Yes
Change COMBO (D5000) if not done yet. Reflash the phone after COMBO change
Run display test with Phoenix (or other OMAP1710 test). OK?
Yes
No
OMAP1710 (D4800), faulty?
No
Yes
Beyond economical repair
Run display test with Phoenix (or other OMAP1710 test). OK?
Yes
No
Problem solved?
Yes
END
No
Go to detailed troubleshooting page
No
Check OMAP1710 (D4800) powers
Measure VCOREA from C4800, C4801, VCOREA=1.4V?
No
Check components and change if faulty: R4800, C4800, C4801, C4802, C4803, C4804, C4805, C4806 & C4807
Measure VCOREA from C4800, C4801, VCOREA=1.4V?
No
Go to general power checking troubleshooting
Yes
Yes
Measure VIO from C4808 VIO=1.8V?
No
Check components and change if faulty: C4808, C4809, C4810, C4811 & C4812
Measure VIO from C4808 VIO=1.8V?
No
Go to general power checking troubleshooting
Yes
Yes
Check OMAP1710 (D4800) clocks
Measure SleepCLK from J2217. SleepCLK=32.768k Hz?
No
Go to dead or jammed device troubleshooting
Yes
See pictures
Measure SysCLK from J4819. SysCLK=19.2MHz?
No
Go to general power checking troubleshooting
Measure SysCLK from J4819. SysCLK=19.2MHz?
No
OMAP1710 (D4800) faulty?
Yes
Beyond economical repair
No
Yes
Yes
OMAP1710 (D4800) boot problems?
Yes
Go to OMAP1710 memory troubleshooting
No
Check APEID with Phoenix phone information read. OK?
No
Reflash phone if not done yet
Run display test with Phoenix (or other OMAP1710 test). OK?
No
Change COMBO (D5000) if not done yet. Reflash the phone after COMBO change
Run display test with Phoenix (or other OMAP1710 test). OK?
No
OMAP1710 (D4800) faulty?
Yes
Beyond economical repair
Yes
Yes
END

Saved: 15 JUN 2004 11:21:49



File
Control
Setup
Measure
Analyze
Utilities
Help
11:21 AM
200 mV/
200 mV/
CLKP
CLKN
More (1of 2)
Clear All
Measurements
Scales

```
Acquisition is stopped.
4.00 GSa/s   4.10 Mpts
```

H 20.0 ns/   0.0 s   T 294 mV

```
                 current         mean            std dev          min              max
Frequency(1)     38.4784 MHz     38.24247 MHz    1.935000 MHz     12.74046 MHz     39.2582 MHz
   Period(1)     25.9886 ns      26.34646 ns     3.92716 ns       25.4724 ns       78.4901 ns
    V max(1)     599.5 mV        625.20 mV       18.34 mV         574.6 mV         690.4 mV
    V min(1)     19.1 mV         40.80 mV        15.43 mV        -13.7 mV          78.5 mV
```

Figure 42 SysCLK from J2800 and J2801

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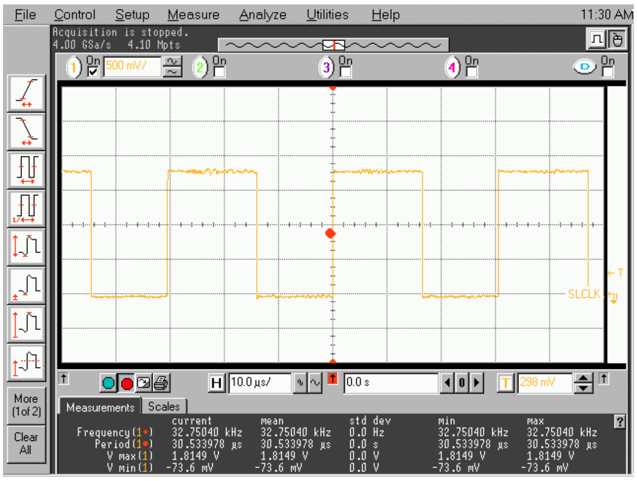


File
Control
Setup
Measure
Analyze
Utilities
Help
11:30 AM
500 mV/
SLCLK
More (1of 2)
Clear All
Measurements
Scales

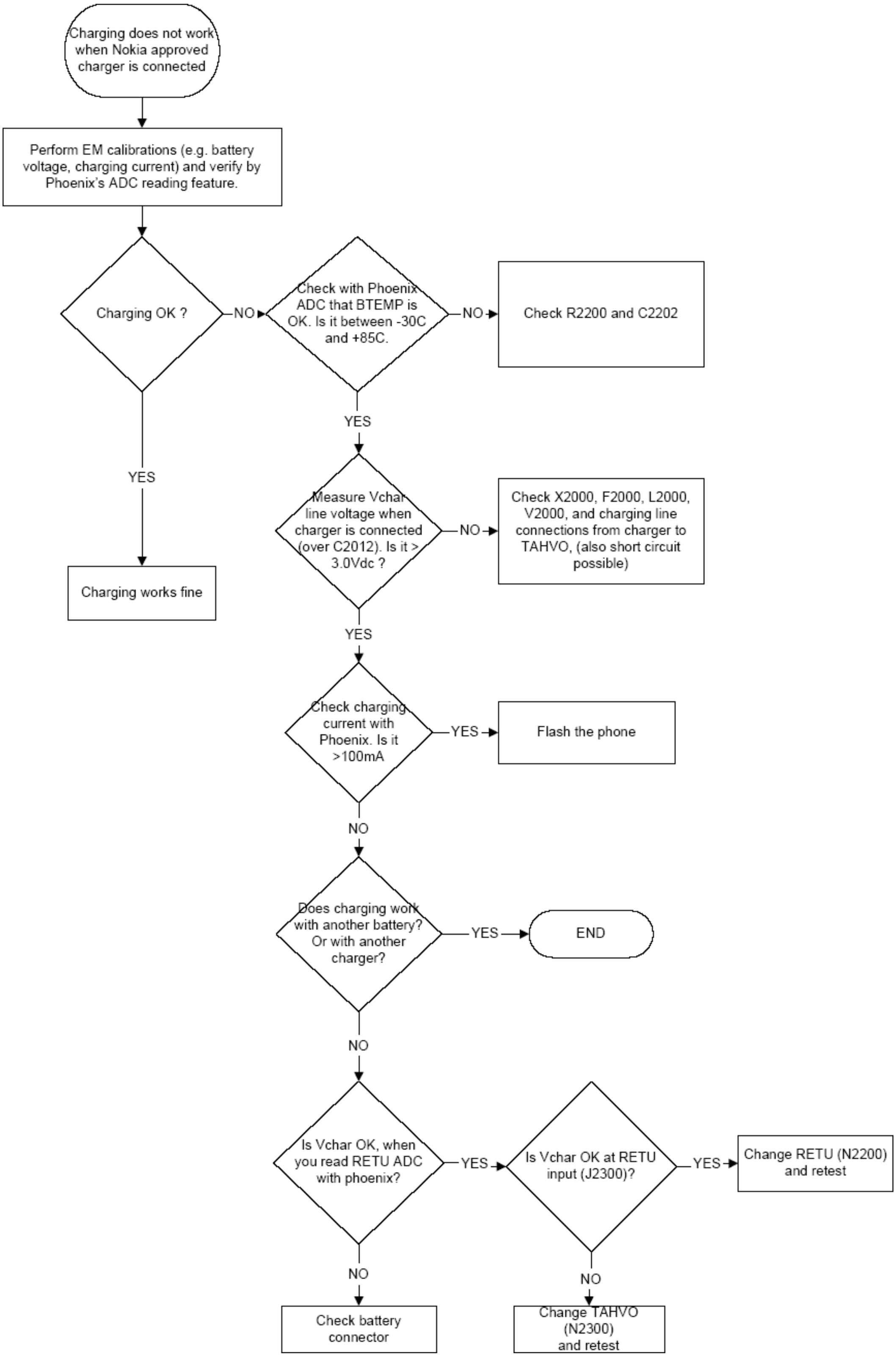
```
Acquisition is stopped.
4.00 GSa/s   4.10 Mpts
```

H 10.0 µs/   0.0 s   T 298 mV

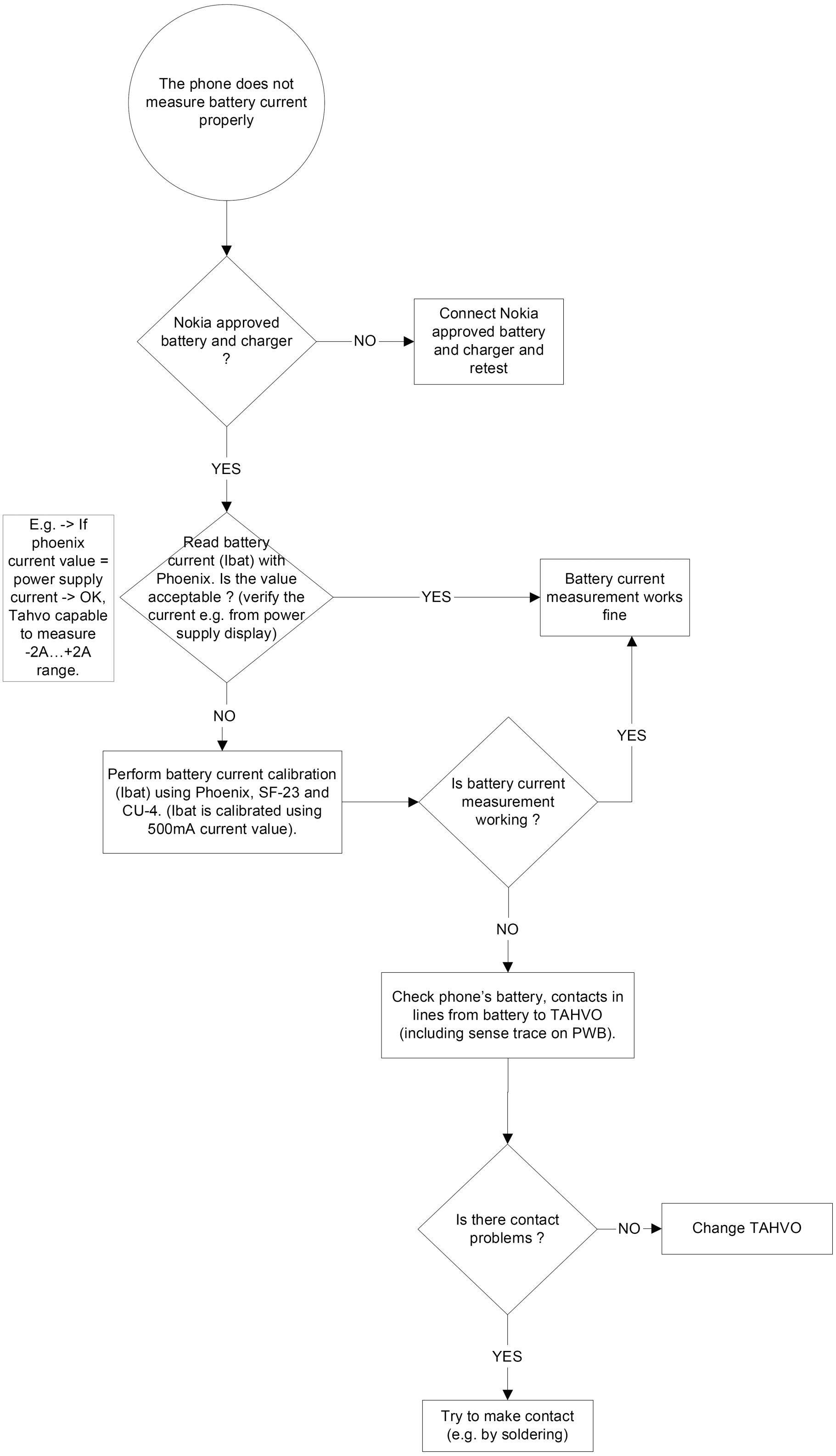
```
                 current         mean            std dev     min              max
Frequency(1)     32.75040 kHz    32.75040 kHz    0.0 Hz      32.75040 kHz     32.75040 kHz
   Period(1)     30.533978 µs    30.533978 µs    0.0 s       30.533978 µs     30.533978 µs
    V max(1)     1.8149 V        1.8149 V        0.0 V       1.8149 V         1.8149 V
    V min(1)    -73.6 mV        -73.6 mV         0.0 V      -73.6 mV         -73.6 mV
```

Figure 43 SleepCLK from J2217

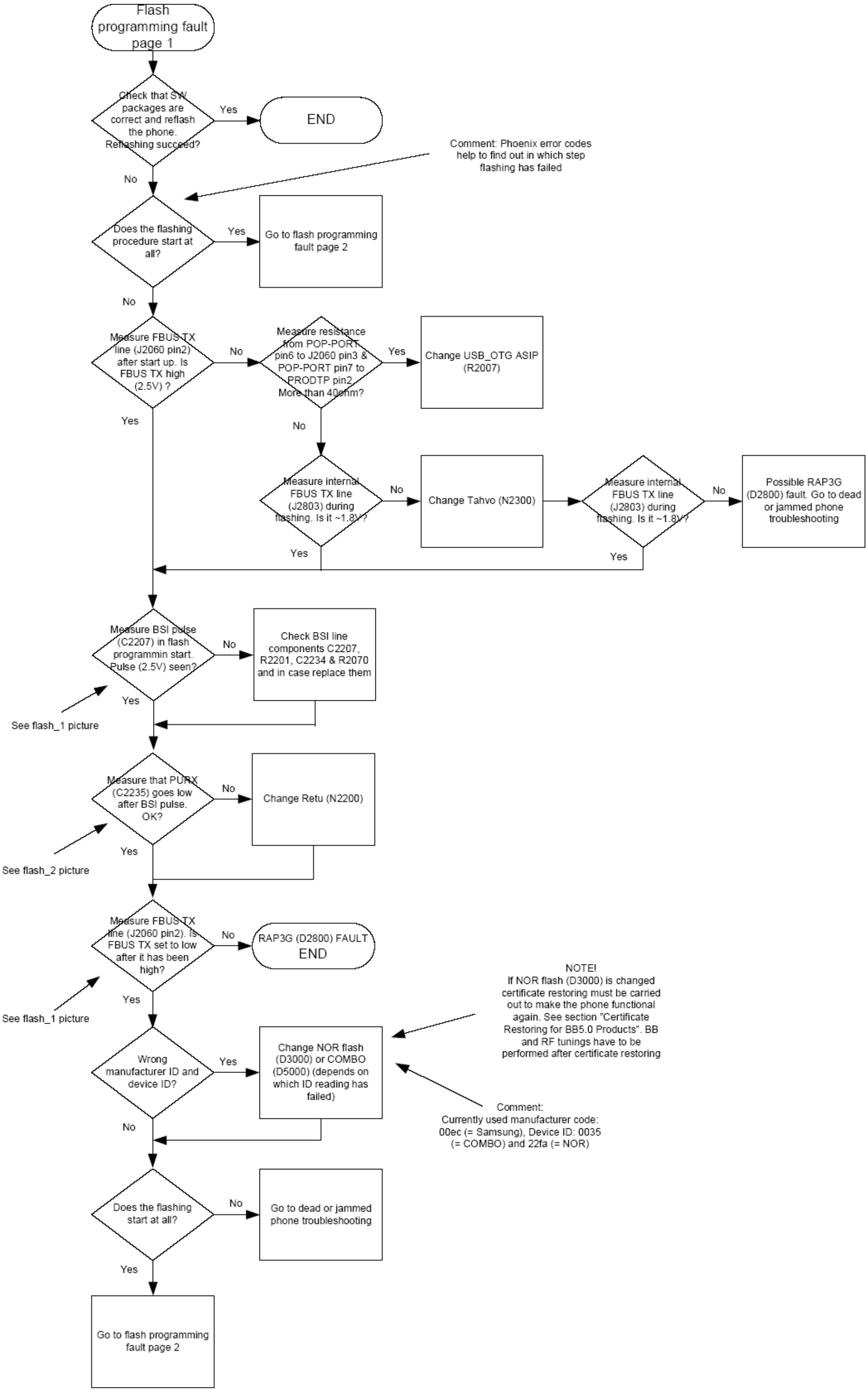
Charging troubleshooting

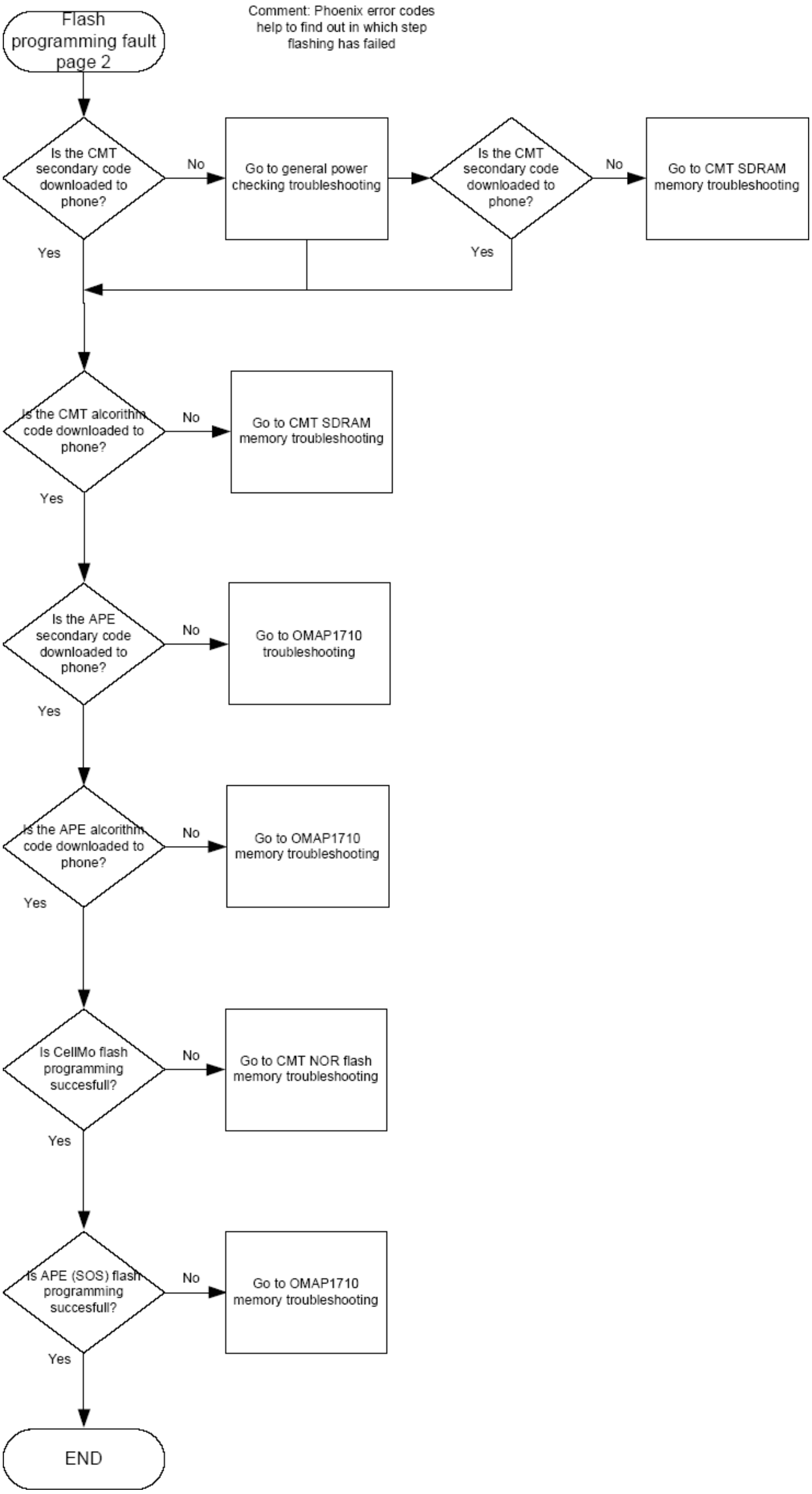

Charging does not work when Nokia approved charger is connected
Perform EM calibrations (e.g. battery voltage, charging current) and verify by Phoenix's ADC reading feature.
Charging OK ?
NO
YES
Charging works fine
Check with Phoenix ADC that BTEMP is OK. Is it between -30C and +85C.
NO
Check R2200 and C2202
YES
Measure Vchar line voltage when charger is connected (over C2012). Is it > 3.0Vdc ?
NO
Check X2000, F2000, L2000, V2000, and charging line connections from charger to TAHVO, (also short circuit possible)
YES
Check charging current with Phoenix. Is it >100mA
YES
Flash the phone
NO
Does charging work with another battery? Or with another charger?
YES
END
NO
Is Vchar OK, when you read RETU ADC with phoenix?
YES
Is Vchar OK at RETU input (J2300)?
YES
Change RETU (N2200) and retest
NO
Change TAHVO (N2300) and retest
NO
Check battery connector

Battery current measuring fault troubleshooting

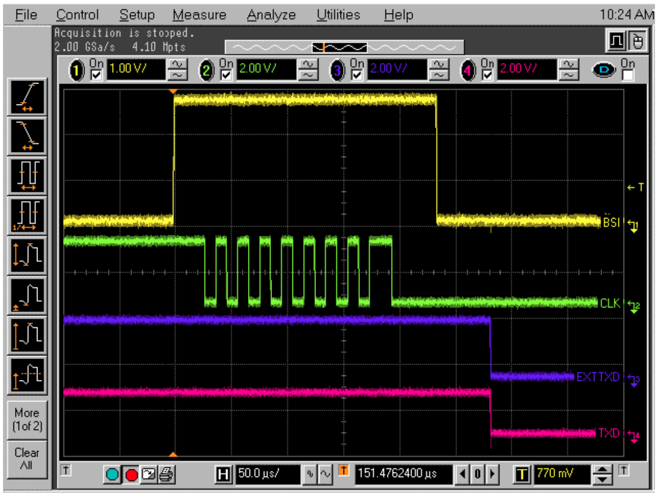

The phone does not measure battery current properly
Nokia approved battery and charger ?
NO
Connect Nokia approved battery and charger and retest
YES
E.g. -> If phoenix current value = power supply current -> OK, Tahvo capable to measure -2A…+2A range.
Read battery current (Ibat) with Phoenix. Is the value acceptable ? (verify the current e.g. from power supply display)
YES
Battery current measurement works fine
NO
YES
Perform battery current calibration (Ibat) using Phoenix, SF-23 and CU-4. (Ibat is calibrated using 500mA current value).
Is battery current measurement working ?
NO
Check phone's battery, contacts in lines from battery to TAHVO (including sense trace on PWB).
Is there contact problems ?
NO
Change TAHVO
YES
Try to make contact (e.g. by soldering)

Flash programming fault troubleshooting


Flash programming fault page 1
Check that SW packages are correct and reflash the phone. Reflashing succeed?
Yes
END
No
Comment: Phoenix error codes help to find out in which step flashing has failed
Does the flashing procedure start at all?
Yes
Go to flash programming fault page 2
No
Measure FBUS TX line (J2060 pin2) after start up. Is FBUS TX high (2.5V) ?
No
Measure resistance from POP-PORT pin6 to J2060 pin3 & POP-PORT pin7 to PRODTP pin2. More than 40ohm?
Yes
Change USB_OTG ASIP (R2007)
No
Measure internal FBUS TX line (J2803) during flashing. Is it ~1.8V?
No
Change Tahvo (N2300)
Measure internal FBUS TX line (J2803) during flashing. Is it ~1.8V?
No
Possible RAP3G (D2800) fault. Go to dead or jammed phone troubleshooting
Yes
Yes
Yes
Measure BSI pulse (C2207) in flash programmin start. Pulse (2.5V) seen?
No
Check BSI line components C2207, R2201, C2234 & R2070 and in case replace them
Yes
See flash_1 picture
Measure that PURX (C2235) goes low after BSI pulse. OK?
No
Change Retu (N2200)
Yes
See flash_2 picture
Measure FBUS TX line (J2060 pin2). Is FBUS TX set to low after it has been high?
No
RAP3G (D2800) FAULT END
Yes
See flash_1 picture
NOTE! If NOR flash (D3000) is changed certificate restoring must be carried out to make the phone functional again. See section "Certificate Restoring for BB5.0 Products". BB and RF tunings have to be performed after certificate restoring
Wrong manufacturer ID and device ID?
Yes
Change NOR flash (D3000) or COMBO (D5000) (depends on which ID reading has failed)
Comment: Currently used manufacturer code: 00ec (= Samsung), Device ID: 0035 (= COMBO) and 22fa (= NOR)
No
Does the flashing start at all?
No
Go to dead or jammed phone troubleshooting
Yes
Go to flash programming fault page 2


Flash programming fault page 2
Comment: Phoenix error codes help to find out in which step flashing has failed
Is the CMT secondary code downloaded to phone?
No
Go to general power checking troubleshooting
Is the CMT secondary code downloaded to phone?
No
Go to CMT SDRAM memory troubleshooting
Yes
Yes
Is the CMT alcorithm code downloaded to phone?
No
Go to CMT SDRAM memory troubleshooting
Yes
Is the APE secondary code downloaded to phone?
No
Go to OMAP1710 troubleshooting
Yes
Is the APE alcorithm code downloaded to phone?
No
Go to OMAP1710 memory troubleshooting
Yes
Is CellMo flash programming succesfull?
No
Go to CMT NOR flash memory troubleshooting
Yes
Is APE (SOS) flash programming succesfull?
No
Go to OMAP1710 memory troubleshooting
Yes
END

Saved: 08 JUL 2004 10:24:00

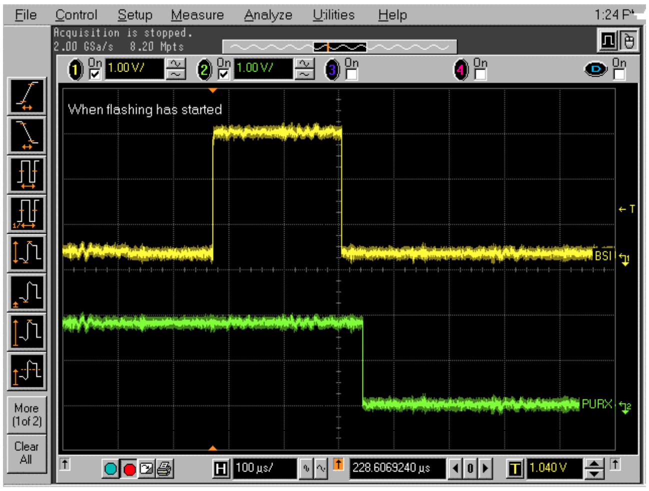


Acquisition is stopped.
2.00 GSa/s 4.10 Mpts

File Control Setup Measure Analyze Utilities Help
10:24 AM
1 On 1.00 V/
2 On 2.00 V/
3 On 2.00 V/
4 On 2.00 V/
On
T
BSI
CLK
EXTTXD
TXD
More (1of 2)
Clear All
H 50.0 µs/
151.4762400 µs
0
T 770 mV

Figure 44 Flashing pic 1. Take single trig measurement for the rise of the BSI signal.

Saved: 05 JUL 2004 13:24:19

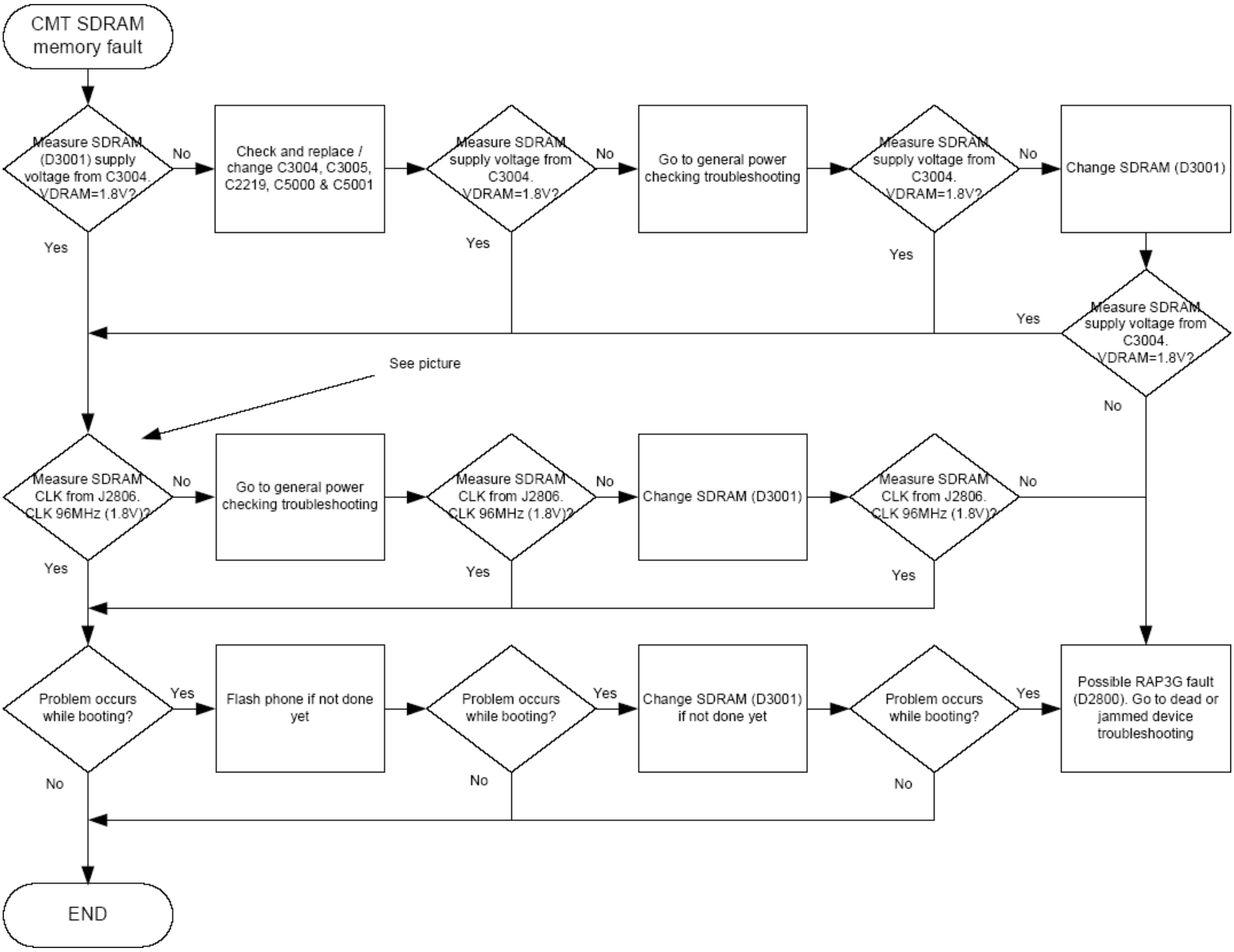


Acquisition is stopped.
2.00 GSa/s 8.20 Mpts

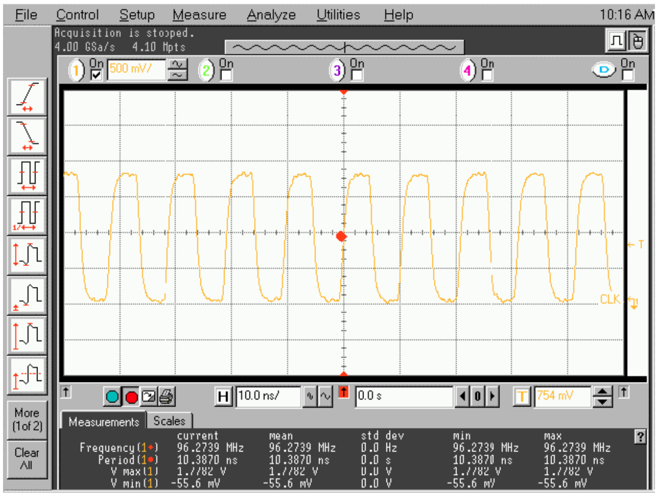
File Control Setup Measure Analyze Utilities Help
1:24 P
1 On 1.00 V/
2 On 1.00 V/
3 On
4 On
On
When flashing has started
T
BSI
PURX
More (1of 2)
Clear All
H 100 µs/
228.6069240 µs
0
T 1.040 V

Figure 45 Flashing pic 2. Take single trig measurement for the rise of the BSI signal.

CMT SDRAM memory troubleshooting


CMT SDRAM memory fault
Measure SDRAM (D3001) supply voltage from C3004. VDRAM=1.8V?
No
Check and replace / change C3004, C3005, C2219, C5000 & C5001
Measure SDRAM supply voltage from C3004. VDRAM=1.8V?
No
Go to general power checking troubleshooting
Measure SDRAM supply voltage from C3004. VDRAM=1.8V?
No
Change SDRAM (D3001)
Yes
Yes
Yes
Yes
Measure SDRAM supply voltage from C3004. VDRAM=1.8V?
No
See picture
Measure SDRAM CLK from J2806. CLK 96MHz (1.8V)?
No
Go to general power checking troubleshooting
Measure SDRAM CLK from J2806. CLK 96MHz (1.8V)?
No
Change SDRAM (D3001)
Measure SDRAM CLK from J2806. CLK 96MHz (1.8V)?
No
Yes
Yes
Yes
Problem occurs while booting?
Yes
Flash phone if not done yet
Problem occurs while booting?
Yes
Change SDRAM (D3001) if not done yet
Problem occurs while booting?
Yes
Possible RAP3G fault (D2800). Go to dead or jammed device troubleshooting
No
No
No
END

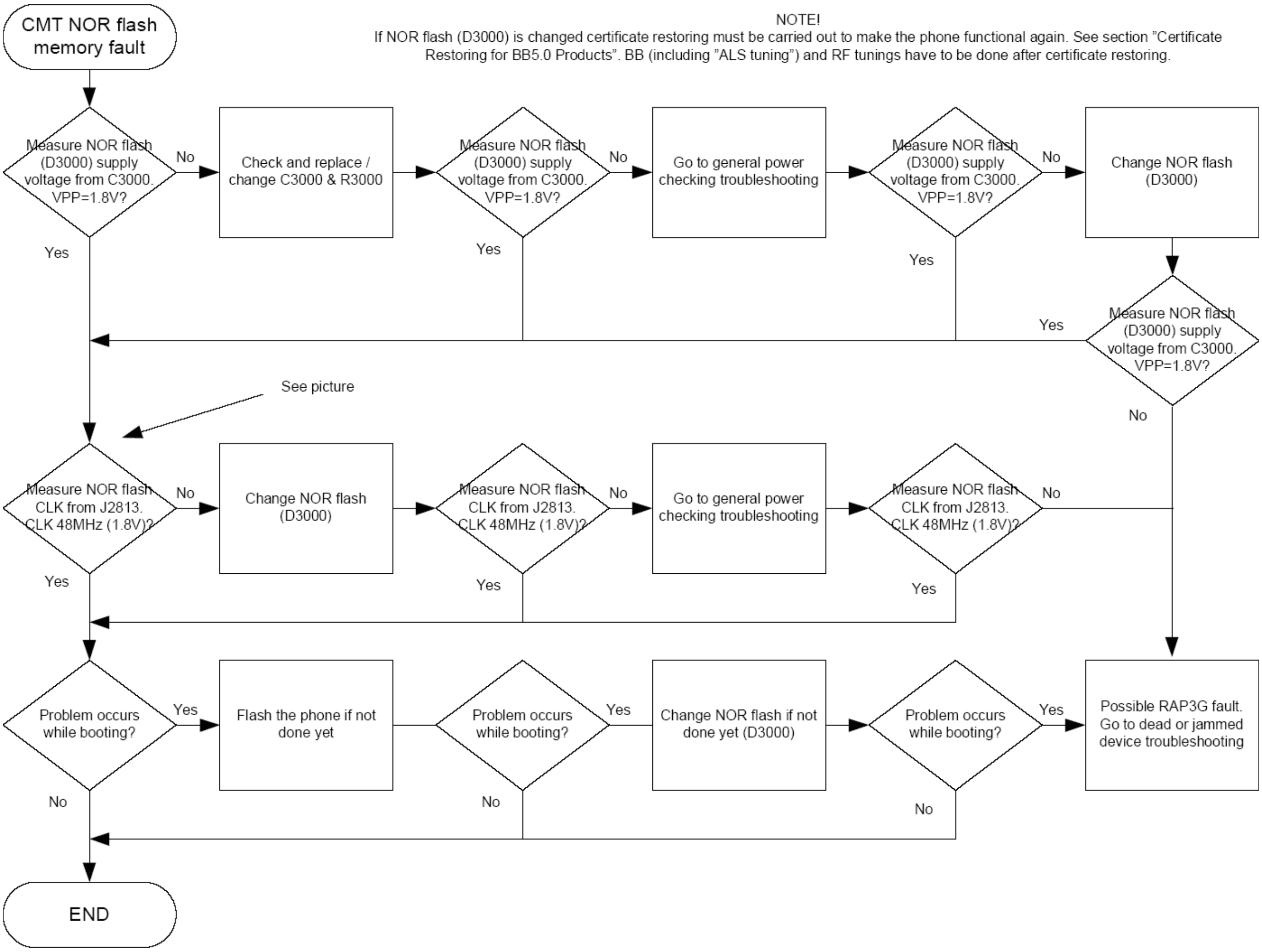
Saved: 15 JUN 2004 10:16:02


File
Control
Setup
Measure
Analyze
Utilities
Help
10:16 AM
Acquisition is stopped.
4.00 GSa/s 4.10 Mpts
1 On ☑ 500 mV/
2 On ☐
3 On ☐
4 On ☐
D On ☐
T
CLK
H 10.0 ns/
0.0 s
0
T 754 mV
More (1of 2)
Clear All
Measurements
Scales

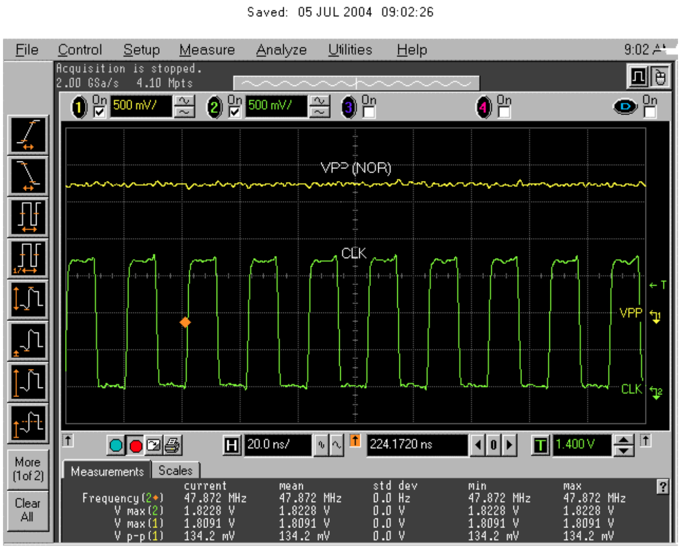
```
                 current        mean           std dev     min            max
Frequency(1)   96.2739 MHz    96.2739 MHz    0.0 Hz      96.2739 MHz    96.2739 MHz
   Period(1)   10.3870 ns     10.3870 ns     0.0 s       10.3870 ns     10.3870 ns
    V max(1)   1.7782 V       1.7782 V       0.0 V       1.7782 V       1.7782 V
    V min(1)  -55.6 mV       -55.6 mV        0.0 V      -55.6 mV       -55.6 mV
```

Figure 46 CMT SDRAM CLK from pin J2806

CMT NOR flash fault troubleshooting


NOTE!
If NOR flash (D3000) is changed certificate restoring must be carried out to make the phone functional again. See section "Certificate Restoring for BB5.0 Products". BB (including "ALS tuning") and RF tunings have to be done after certificate restoring.

CMT NOR flash memory fault
Measure NOR flash (D3000) supply voltage from C3000. VPP=1.8V?
No
Yes
Check and replace / change C3000 & R3000
Measure NOR flash (D3000) supply voltage from C3000. VPP=1.8V?
No
Yes
Go to general power checking troubleshooting
Measure NOR flash (D3000) supply voltage from C3000. VPP=1.8V?
No
Yes
Change NOR flash (D3000)
Measure NOR flash (D3000) supply voltage from C3000. VPP=1.8V?
Yes
No
See picture
Measure NOR flash CLK from J2813. CLK 48MHz (1.8V)?
No
Yes
Change NOR flash (D3000)
Measure NOR flash CLK from J2813. CLK 48MHz (1.8V)?
No
Yes
Go to general power checking troubleshooting
Measure NOR flash CLK from J2813. CLK 48MHz (1.8V)?
No
Yes
Problem occurs while booting?
Yes
No
Flash the phone if not done yet
Problem occurs while booting?
Yes
No
Change NOR flash if not done yet (D3000)
Problem occurs while booting?
Yes
No
Possible RAP3G fault. Go to dead or jammed device troubleshooting
END


Saved: 05 JUL 2004 09:02:26

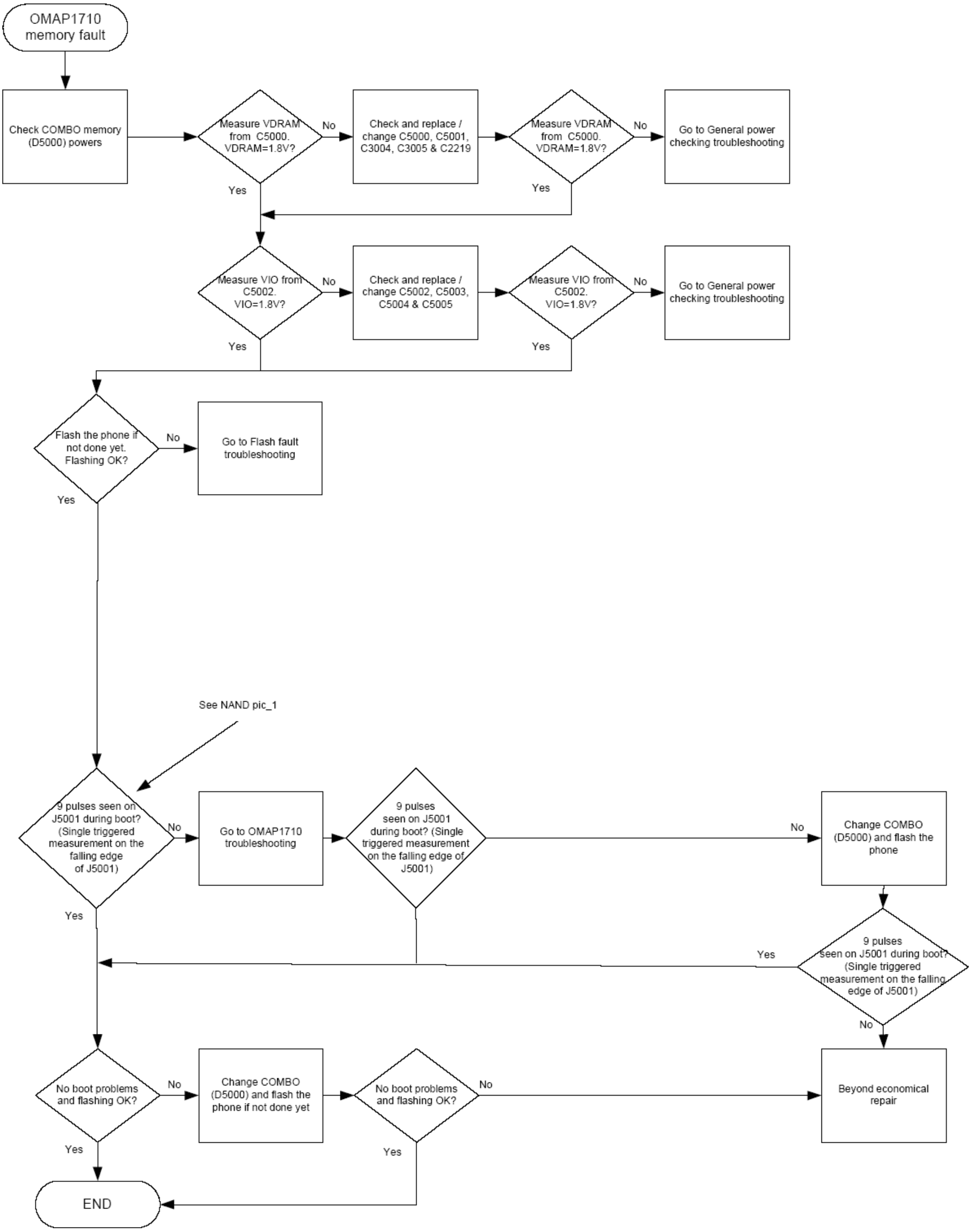
```
Acquisition is stopped.
2.00 GSa/s   4.10 Mpts
```

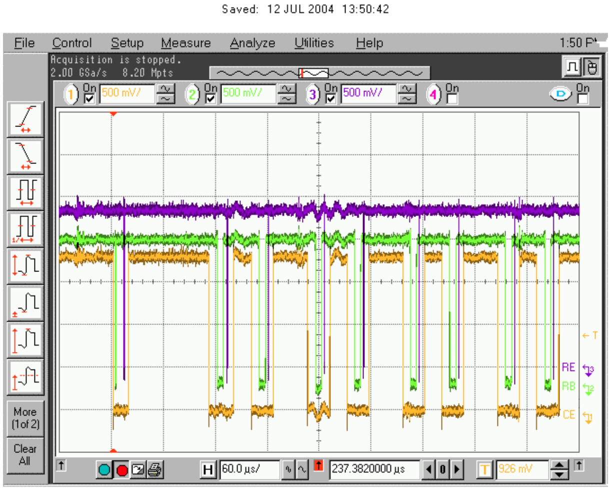
File
Control
Setup
Measure
Analyze
Utilities
Help
9:02 A
1 On 500 mV/
2 On 500 mV/
3 On
4 On
On
VPP (NOR)
CLK
T
VPP
CLK
H 20.0 ns/
224.1720 ns
0
T 1.400 V
More (1of 2)
Clear All
Measurements
Scales

```
                current      mean         std dev     min          max
Frequency(2)   47.872 MHz   47.872 MHz   0.0 Hz      47.872 MHz   47.872 MHz
    V max(2)   1.8228 V     1.8228 V     0.0 V       1.8228 V     1.8228 V
    V max(1)   1.8091 V     1.8091 V     0.0 V       1.8091 V     1.8091 V
    V p-p(1)   134.2 mV     134.2 mV     0.0 V       134.2 mV     134.2 mV
```

Figure 47 NOR CLK from J2813

OMAP1710 memory troubleshooting


OMAP1710 memory fault
Check COMBO memory (D5000) powers
Measure VDRAM from C5000. VDRAM=1.8V?
No
Check and replace / change C5000, C5001, C3004, C3005 & C2219
Measure VDRAM from C5000. VDRAM=1.8V?
No
Go to General power checking troubleshooting
Yes
Yes
Measure VIO from C5002. VIO=1.8V?
No
Check and replace / change C5002, C5003, C5004 & C5005
Measure VIO from C5002. VIO=1.8V?
No
Go to General power checking troubleshooting
Yes
Yes
Flash the phone if not done yet. Flashing OK?
No
Go to Flash fault troubleshooting
Yes
See NAND pic_1
9 pulses seen on J5001 during boot? (Single triggered measurement on the falling edge of J5001)
No
Go to OMAP1710 troubleshooting
9 pulses seen on J5001 during boot? (Single triggered measurement on the falling edge of J5001)
No
Change COMBO (D5000) and flash the phone
Yes
9 pulses seen on J5001 during boot? (Single triggered measurement on the falling edge of J5001)
Yes
No
No boot problems and flashing OK?
No
Change COMBO (D5000) and flash the phone if not done yet
No boot problems and flashing OK?
No
Beyond economical repair
Yes
Yes
END

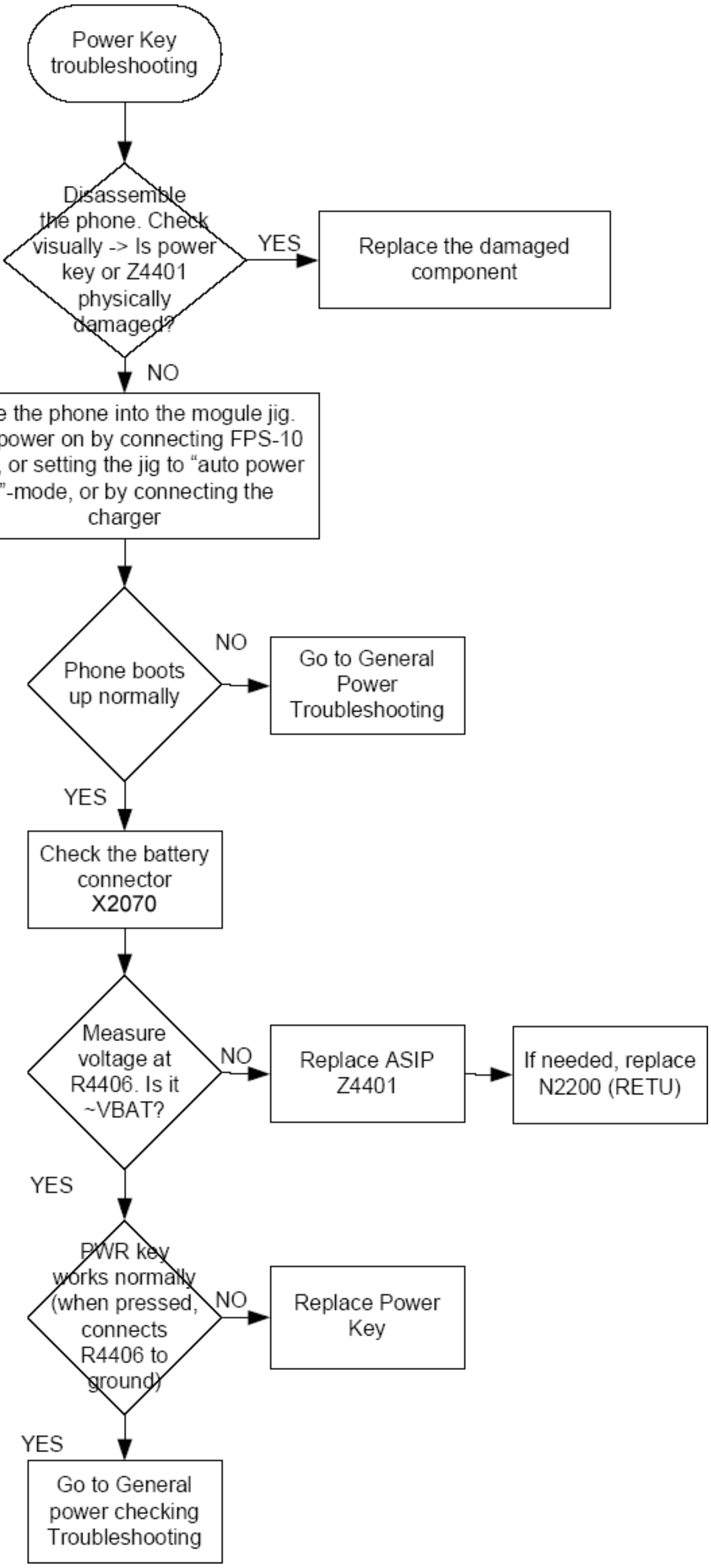

Saved: 12 JUL 2004 13:50:42
File
Control
Setup
Measure
Analyze
Utilities
Help
Acquisition is stopped.
2.00 GSa/s 8.20 Mpts
500 mV/
500 mV/
500 mV/
On
RE
RB
CE
More (1 of 2)
Clear All
H 60.0 µs/
237.3820000 µs
926 mV

Legend

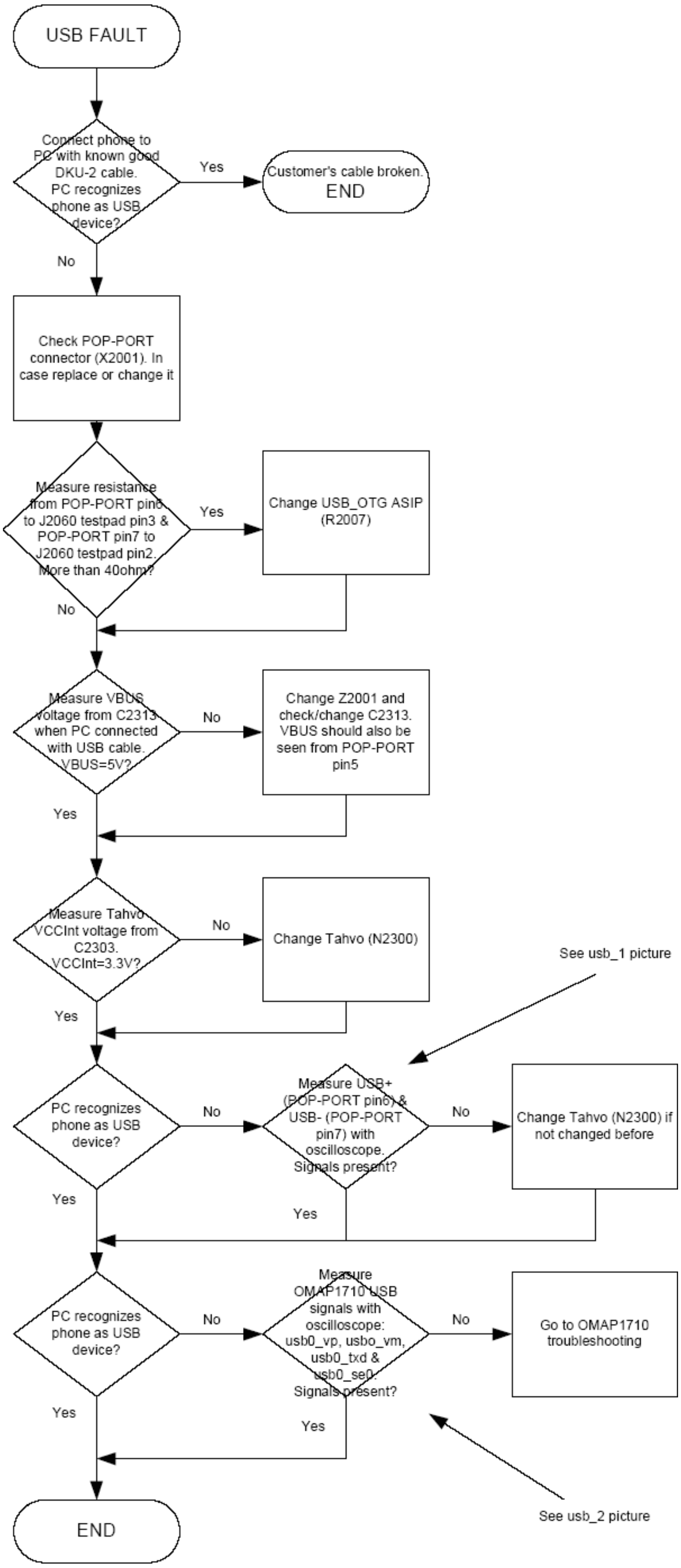
Take single trig measurement on the falling edge of the CE signal.

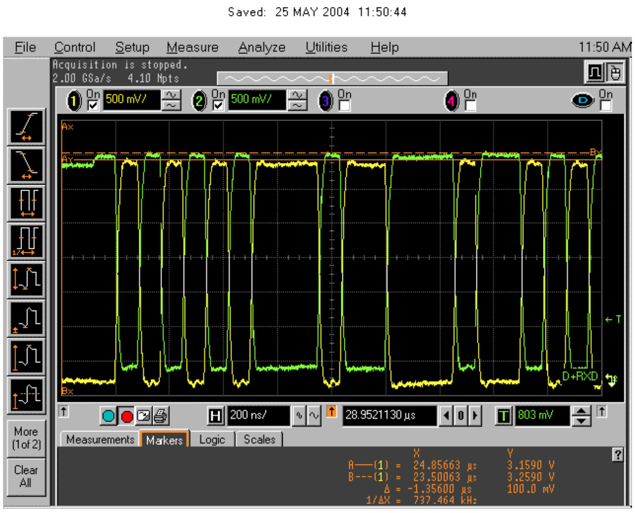
Figure 48 COMBO NAND in boot pic 1.

Power key troubleshooting


Power Key troubleshooting
Disassemble the phone. Check visually -> Is power key or Z4401 physically damaged?
YES
Replace the damaged component
NO
Place the phone into the mogule jig. Turn power on by connecting FPS-10 cable, or setting the jig to “auto power on”-mode, or by connecting the charger
Phone boots up normally
NO
Go to General Power Troubleshooting
YES
Check the battery connector X2070
Measure voltage at R4406. Is it ~VBAT?
NO
Replace ASIP Z4401
If needed, replace N2200 (RETU)
YES
PWR key works normally (when pressed, connects R4406 to ground)
NO
Replace Power Key
YES
Go to General power checking Troubleshooting

USB interface troubleshooting


USB FAULT
Connect phone to PC with known good DKU-2 cable. PC recognizes phone as USB device?
Yes
Customer's cable broken. END
No
Check POP-PORT connector (X2001). In case replace or change it
Measure resistance from POP-PORT pin6 to J2060 testpad pin3 & POP-PORT pin7 to J2060 testpad pin2. More than 40ohm?
Yes
Change USB_OTG ASIP (R2007)
No
Measure VBUS voltage from C2313 when PC connected with USB cable. VBUS=5V?
No
Change Z2001 and check/change C2313. VBUS should also be seen from POP-PORT pin5
Yes
Measure Tahvo VCCInt voltage from C2303. VCCInt=3.3V?
No
Change Tahvo (N2300)
Yes
See usb_1 picture
PC recognizes phone as USB device?
No
Measure USB+ (POP-PORT pin6) & USB- (POP-PORT pin7) with oscilloscope. Signals present?
No
Change Tahvo (N2300) if not changed before
Yes
Yes
PC recognizes phone as USB device?
No
Measure OMAP1710 USB signals with oscilloscope: usb0_vp, usbo_vm, usb0_txd & usb0_se0. Signals present?
No
Go to OMAP1710 troubleshooting
Yes
Yes
See usb_2 picture
END



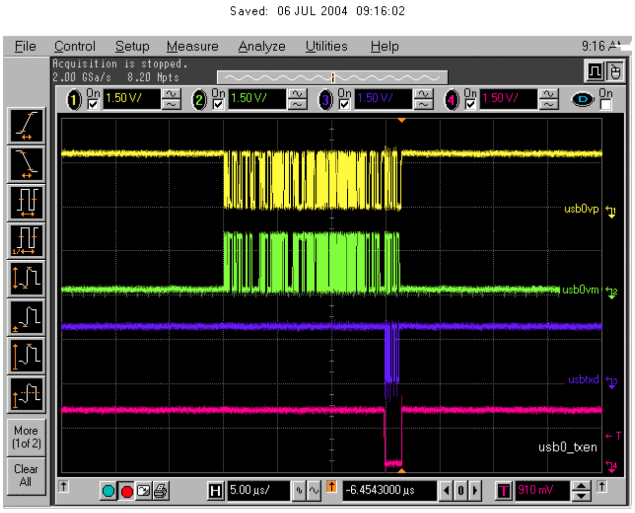
Saved: 25 MAY 2004 11:50:44

```
Acquisition is stopped.
2.00 GSa/s    4.10 Mpts
```

```
                 X               Y
A——(1) =  24.85663 µs     3.1590 V
B---(1) =  23.50063 µs    3.2590 V
      Δ = -1.35600 µs     100.0 mV
   1/ΔX =  737.464 kHz
```

File
Control
Setup
Measure
Analyze
Utilities
Help
11:50 AM
1 On 500 mV/
2 On 500 mV/
3 On
4 On
D On
Ax
Ay
Bx
By
← T
D+RXD
More (1 of 2)
Clear All
200 ns/
28.9521130 µs
803 mV
Measurements
Markers
Logic
Scales

Figure 49 USB 1: D-TXD (POP-PORT pin6) and D+RXD (POP-PORT pin7) voltage levels when USB connected.



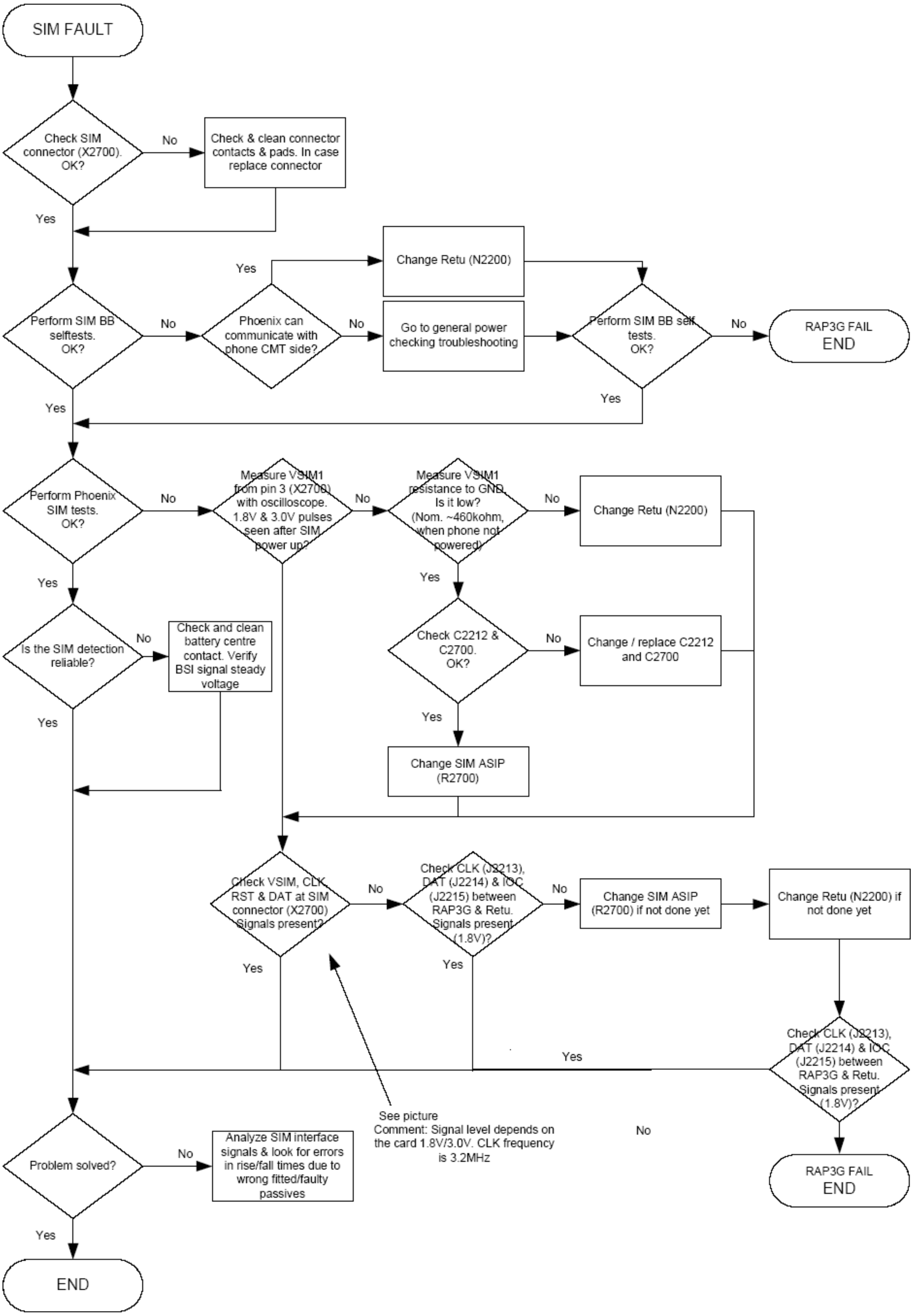
Saved: 06 JUL 2004 09:16:02

```
Acquisition is stopped.
2.00 GSa/s    8.20 Mpts
```

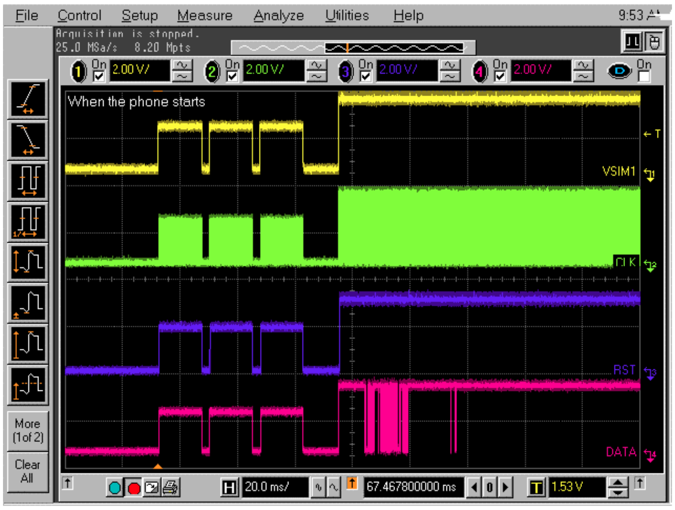
File
Control
Setup
Measure
Analyze
Utilities
Help
9:16 AM
1 On 1.50 V/
2 On 1.50 V/
3 On 1.50 V/
4 On 1.50 V/
D On
usb0vp
usb0vm
usbtxd
← T
usb0_txen
More (1 of 2)
Clear All
5.00 µs/
-6.4543000 µs
910 mV

Figure 50 USB 2: Take single triggered measurement on the rising edge of the Helen usb0_txen line.

SIM card troubleshooting


SIM FAULT
Check SIM connector (X2700). OK?
No
Check & clean connector contacts & pads. In case replace connector
Yes
Change Retu (N2200)
Yes
Perform SIM BB selftests. OK?
No
Phoenix can communicate with phone CMT side?
No
Go to general power checking troubleshooting
Perform SIM BB self tests. OK?
No
RAP3G FAIL END
Yes
Yes
Perform Phoenix SIM tests. OK?
No
Measure VSIM1 from pin 3 (X2700) with oscilloscope. 1.8V & 3.0V pulses seen after SIM power up?
No
Measure VSIM1 resistance to GND. Is it low? (Nom. ~460kohm, when phone not powered)
No
Change Retu (N2200)
Yes
Yes
Is the SIM detection reliable?
No
Check and clean battery centre contact. Verify BSI signal steady voltage
Check C2212 & C2700. OK?
No
Change / replace C2212 and C2700
Yes
Yes
Change SIM ASIP (R2700)
Check VSIM, CLK, RST & DAT at SIM connector (X2700) Signals present?
No
Check CLK (J2213), DAT (J2214) & IOC (J2215) between RAP3G & Retu. Signals present (1.8V)?
No
Change SIM ASIP (R2700) if not done yet
Change Retu (N2200) if not done yet
Yes
Yes
Yes
Check CLK (J2213), DAT (J2214) & IOC (J2215) between RAP3G & Retu. Signals present (1.8V)?
See picture
Comment: Signal level depends on the card 1.8V/3.0V. CLK frequency is 3.2MHz
No
Problem solved?
No
Analyze SIM interface signals & look for errors in rise/fall times due to wrong fitted/faulty passives
RAP3G FAIL END
Yes
END

Saved: 05 JUL 2004 09:53:41

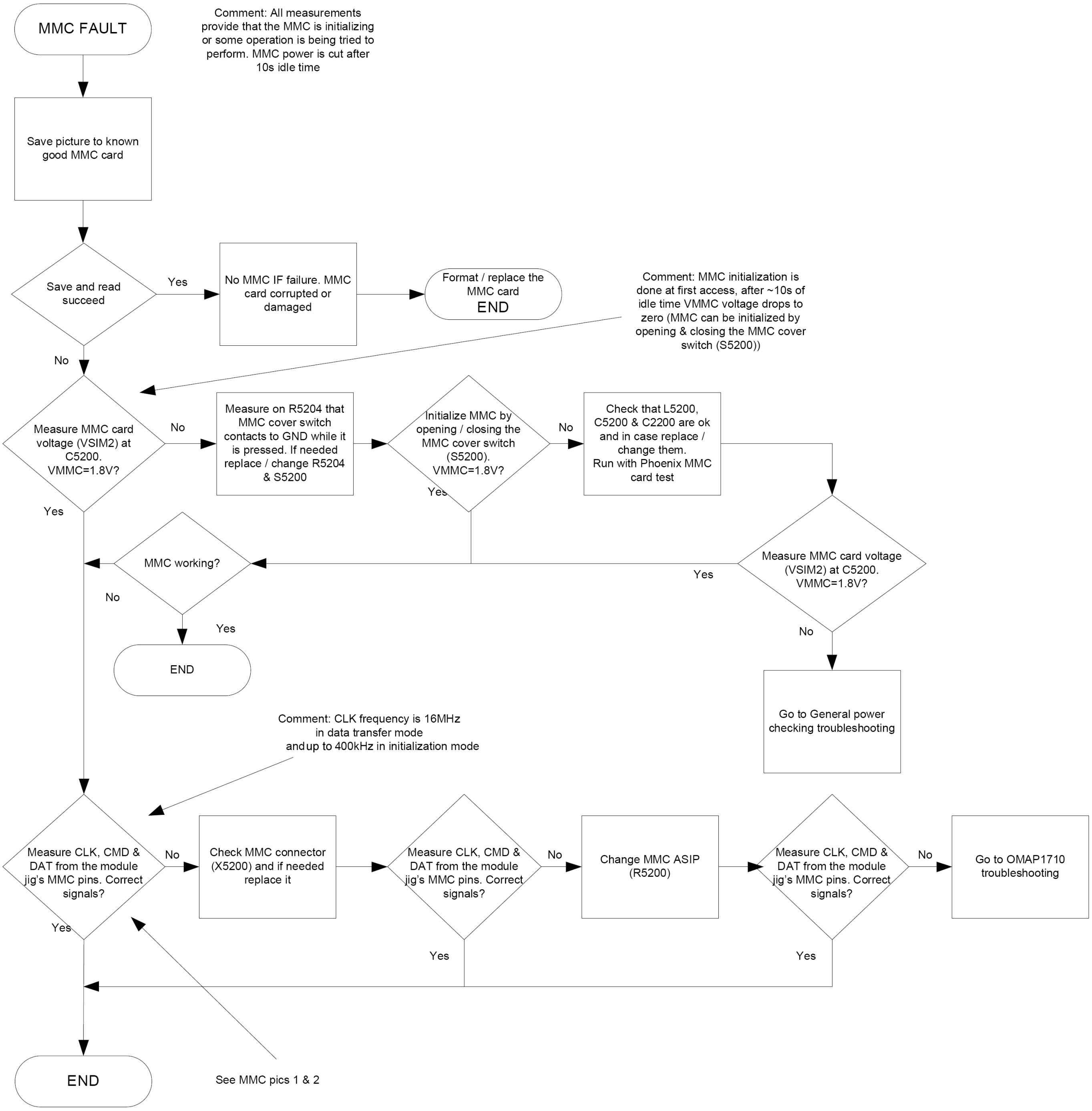

File
Control
Setup
Measure
Analyze
Utilities
Help
Acquisition is stopped.
25.0 MSa/s 8.20 Mpts
2.00 V/
2.00 V/
2.00 V/
2.00 V/
When the phone starts
VSIM1
CLK
RST
DATA
More (1 of 2)
Clear All
20.0 ms/
67.467800000 ms
1.53 V

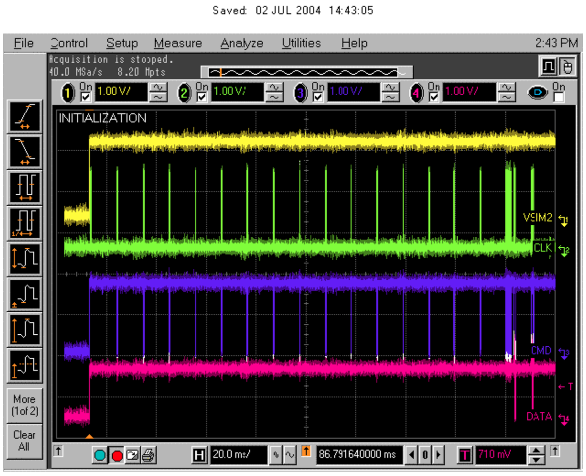
Legend

SIM CLK frequency = 3.2MHz (Take single triggered measurement in boot on the VSIM1 line).

Figure 51 SIM interface signals

MMC troubleshooting

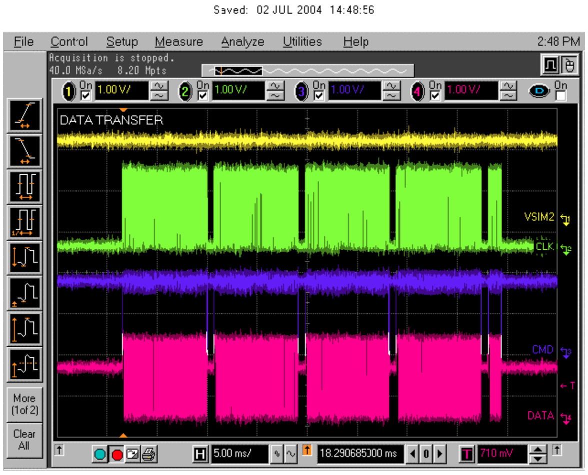

MMC FAULT
Comment: All measurements provide that the MMC is initializing or some operation is being tried to perform. MMC power is cut after 10s idle time
Save picture to known good MMC card
Save and read succeed
Yes
No MMC IF failure. MMC card corrupted or damaged
Format / replace the MMC card
END
Comment: MMC initialization is done at first access, after ~10s of idle time VMMC voltage drops to zero (MMC can be initialized by opening & closing the MMC cover switch (S5200))
No
Measure MMC card voltage (VSIM2) at C5200. VMMC=1.8V?
No
Measure on R5204 that MMC cover switch contacts to GND while it is pressed. If needed replace / change R5204 & S5200
Initialize MMC by opening / closing the MMC cover switch (S5200). VMMC=1.8V?
No
Check that L5200, C5200 & C2200 are ok and in case replace / change them. Run with Phoenix MMC card test
Yes
Yes
MMC working?
No
Yes
END
Measure MMC card voltage (VSIM2) at C5200. VMMC=1.8V?
Yes
No
Go to General power checking troubleshooting
Comment: CLK frequency is 16MHz in data transfer mode and up to 400kHz in initialization mode
Measure CLK, CMD & DAT from the module jig's MMC pins. Correct signals?
No
Check MMC connector (X5200) and if needed replace it
Measure CLK, CMD & DAT from the module jig's MMC pins. Correct signals?
No
Change MMC ASIP (R5200)
Measure CLK, CMD & DAT from the module jig's MMC pins. Correct signals?
No
Go to OMAP1710 troubleshooting
Yes
Yes
Yes
END
See MMC pics 1 & 2


Saved: 02 JUL 2004 14:43:05
File Control Setup Measure Analyze Utilities Help
2:43 PM
Acquisition is stopped.
40.0 MSa/s 8.20 Mpts
1.00 V/
1.00 V/
1.00 V/
1.00 V/
INITIALIZATION
VSIM2
CLK
CMD
DATA
More (1 of 2)
Clear All
20.0 ms/
86.791640000 ms
710 mV

Legend

Take singe trig measurement on the rising edge of the DAT signal.

Figure 52 MMC card initialization


Saved: 02 JUL 2004 14:48:56
File Control Setup Measure Analyze Utilities Help
2:48 PM
Acquisition is stopped.
40.0 MSa/s 8.20 Mpts
1.00 V/
1.00 V/
1.00 V/
1.00 V/
DATA TRANSFER
VSIM2
CLK
CMD
DATA
More (1 of 2)
Clear All
5.00 ms/
18.290685300 ms
710 mV

Legend

Take single trig measurement on the rising edge of the DAT signal.

Figure 53 Data transfer

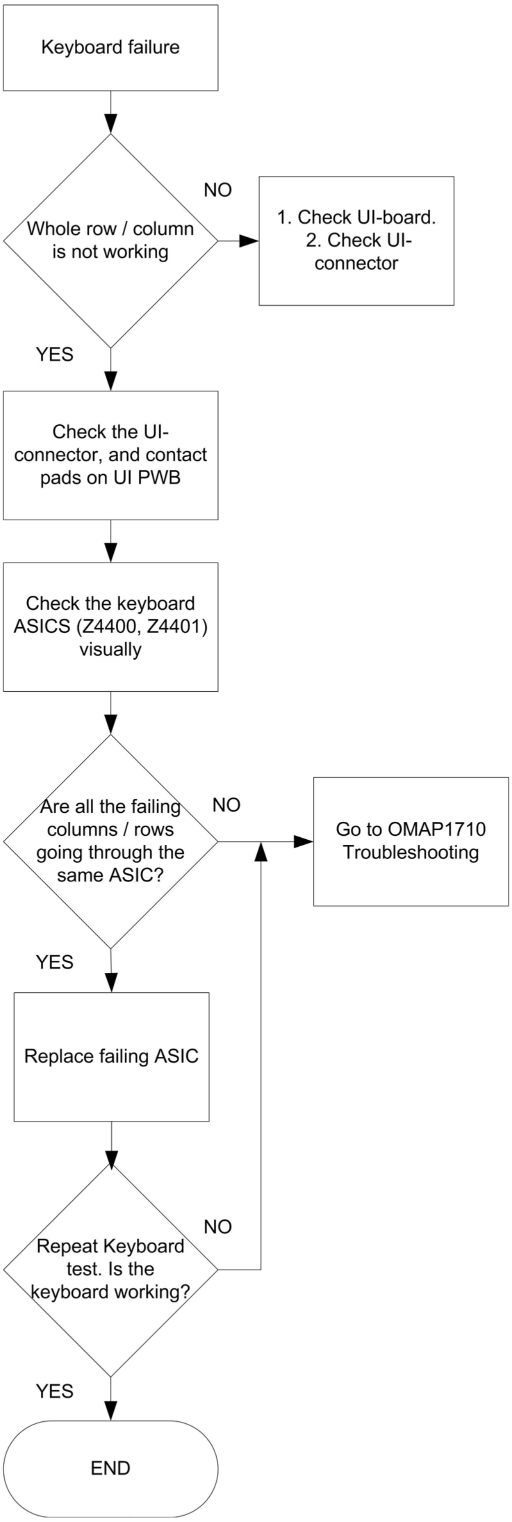
Keyboard troubleshooting

Context

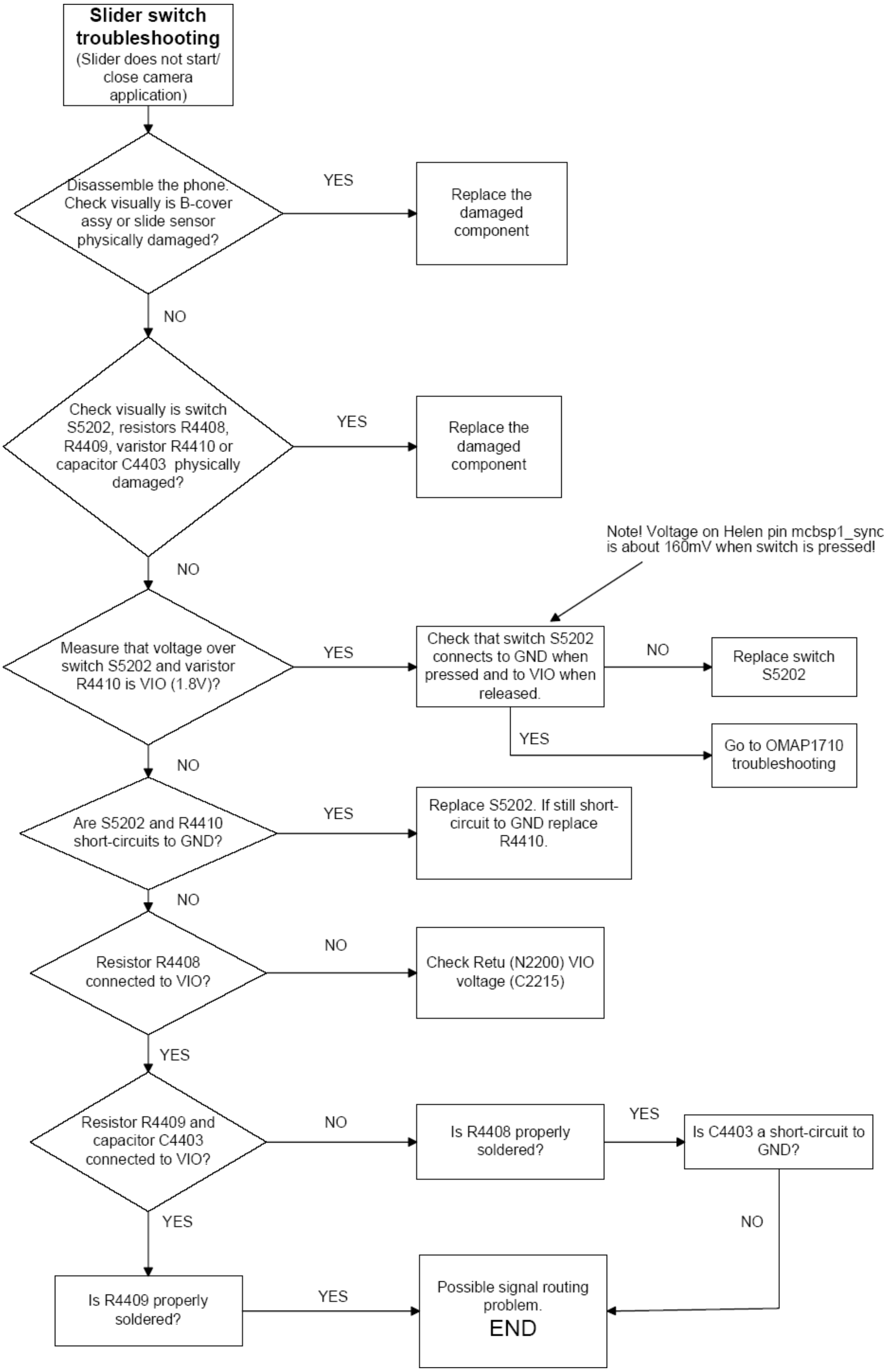
There are two possible failure modes in the keyboard module:

- One or more keys can be stuck, so that the key does not react when a keydome is pressed. This kind of failure is caused by mechanical reasons (dirt, rust).
- Malfunction of several keys at the same time; this happens when one or more rows or columns are failing (shortcut or open connection). For a more detailed description of the keyboard and keymatrix, see section Keyboard (Page 9–21).

If the failure mode is not clear, start with the Keyboard Test in Phoenix.


Keyboard failure
Whole row / column is not working
NO
1. Check UI-board. 2. Check UI-connector
YES
Check the UI-connector, and contact pads on UI PWB
Check the keyboard ASICS (Z4400, Z4401) visually
Are all the failing columns / rows going through the same ASIC?
NO
Go to OMAP1710 Troubleshooting
YES
Replace failing ASIC
Repeat Keyboard test. Is the keyboard working?
NO
YES
END

Slider switch troubleshooting


Slider switch troubleshooting
(Slider does not start/ close camera application)
Disassemble the phone. Check visually is B-cover assy or slide sensor physically damaged?
YES
Replace the damaged component
NO
Check visually is switch S5202, resistors R4408, R4409, varistor R4410 or capacitor C4403 physically damaged?
YES
Replace the damaged component
NO
Note! Voltage on Helen pin mcbsp1_sync is about 160mV when switch is pressed!
Measure that voltage over switch S5202 and varistor R4410 is VIO (1.8V)?
YES
Check that switch S5202 connects to GND when pressed and to VIO when released.
NO
Replace switch S5202
YES
Go to OMAP1710 troubleshooting
NO
Are S5202 and R4410 short-circuits to GND?
YES
Replace S5202. If still short-circuit to GND replace R4410.
NO
Resistor R4408 connected to VIO?
NO
Check Retu (N2200) VIO voltage (C2215)
YES
Resistor R4409 and capacitor C4403 connected to VIO?
NO
Is R4408 properly soldered?
YES
Is C4403 a short-circuit to GND?
NO
YES
Is R4409 properly soldered?
YES
Possible signal routing problem.
END

Certificate restoring for BB5.0 products

Context

After replacing a defective Flash memory component in BB 5.0 products, Certificate Restoring must be carried out to make the phone functional again.

Certificate restoring for BB5.0 products is basically the same process as IMEI / ESN Rebuild for DCT-4 generation products.

All tunings (RF & Baseband, UI) must be done after replacing the flash IC.

The procedure for Certificate Restoring when Flash IC has been replaced:

- Flash the phone with the latest available software (Use FPS-8 or FPS-10, USB Flashing does not work for a dead BB5.0 phone).
- Create a request file.
- Send the file to Nokia by e-mail.
- When you receive a reply from Nokia, carry out Certificate Restoring.
- Tune the phone completely (Note: SX-4 Smart Card is needed).
- If phone resets after a certificate restore, reflash the phone again.

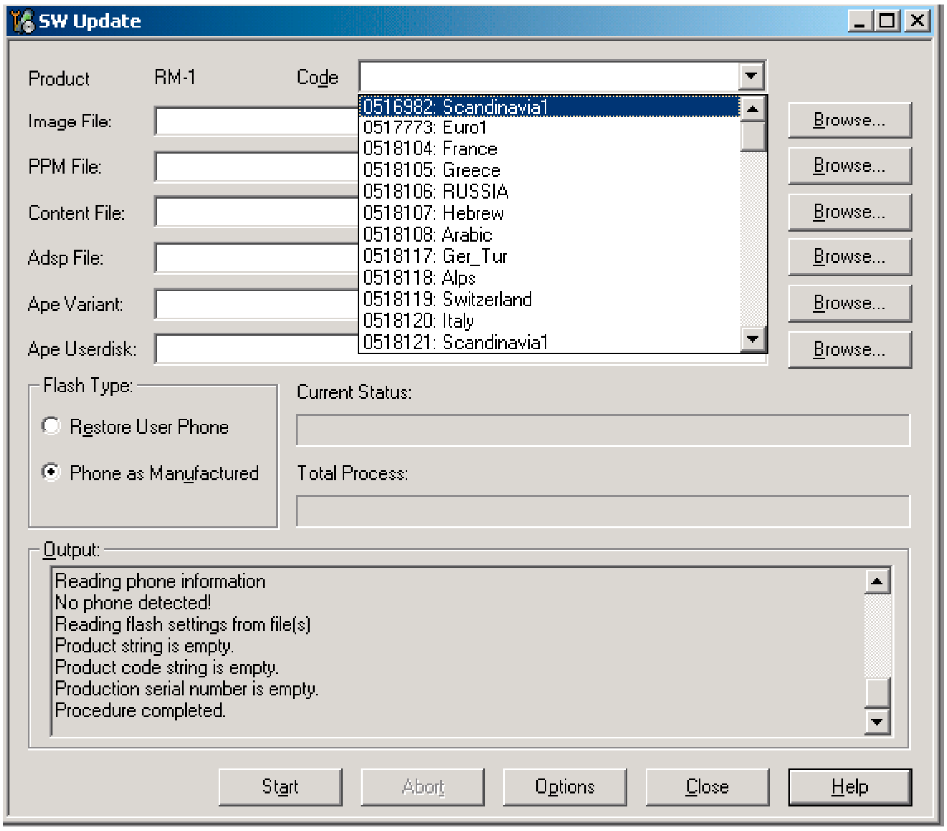
Required equipment and setup:

- Phoenix Service software v 2004.39.7.70 or newer.
- The latest phone model specific Phoenix Data Package.
- PKD-1 Dongle
- SX-4 Smart Card (Enables BB 5.0 testing and tuning features)
- External Smart card reader (Only when FPS-8 is used, FPS-10 has an integrated SC reader)
- Activated FPS-8 flash prommer **OR** FPS-10 flash prommer
- Flash update package 03.18.004 or newer for FPS-8 or FPS-10 flash prommers
- CU-4 control unit
- USB cable from PC USB Port to CU-4 control unit
- Phone model specific adapter for CU-4 control unit
- PCS-1 cable to power CU-4 from external power supply
- XCS-4 modular cable between flash prommer and CU-4

Note: CU-4 must be supplied with +12V from external power supply in all steps of Certificate Restoring.

Steps

1. Program the phone software.
   i Start Phoenix and login. Make sure the connection has been managed correctly for FPS-8 or FPS-10.
   ii Update the phone MCU software to the latest available version.
   If the new flash is empty and the phone cannot communicate with Phoenix, the procedure in this case is a “Dead Phone Flash” described below.
   iii Choose the product manually from File -> Open Product, and click “OK”.
   Wait for the phone type designator (e.g. “RM-1”) to be displayed at the bottom of the screen.
   iv Go to Flashing –> SW Update and wait until Phoenix reads the product data as shown in the following picture.


SW Update
Image File:
PPM File:
Content File:
Adsp File:
Ape Variant:
Ape Userdisk:
Browse...
Browse...
Browse...
Browse...
Browse...
Browse...
Current Status:
Total Process:
Start
Abort
Options
Close
Help

Product RM-1

Code

0516982: Scandinavia1
0517773: Euro1
0518104: France
0518105: Greece
0518106: RUSSIA
0518107: Hebrew
0518108: Arabic
0518117: Ger_Tur
0518118: Alps
0518119: Switzerland
0518120: Italy
0518121: Scandinavia1

Flash Type:
○ Restore User Phone
● Phone as Manufactured

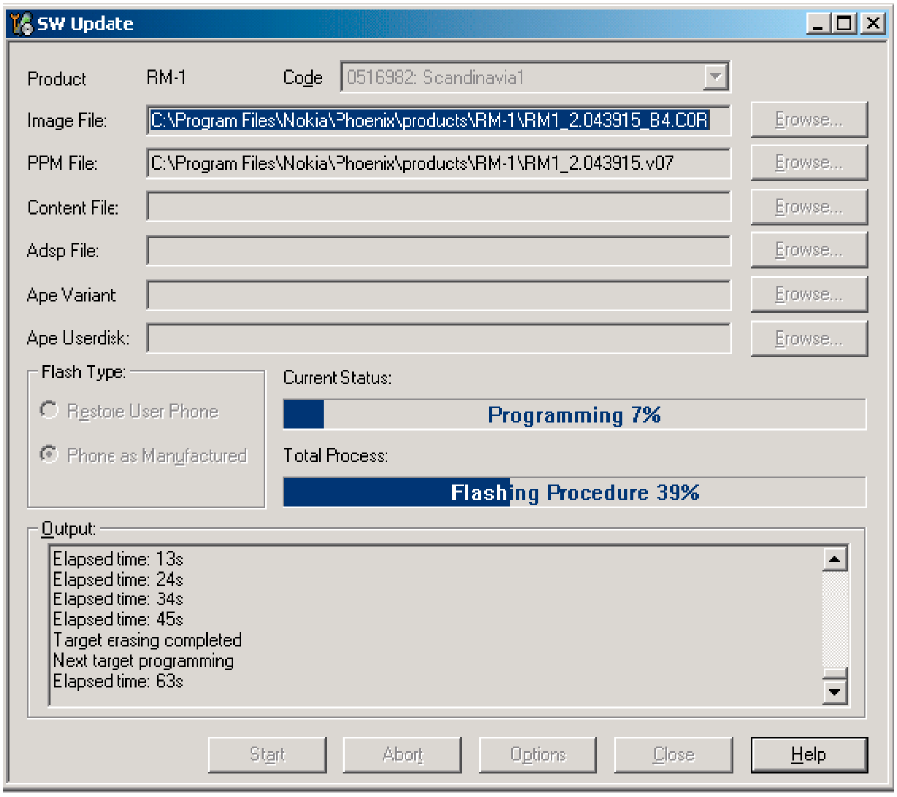
Output:

```
Reading phone information
No phone detected!
Reading flash settings from file(s)
Product string is empty.
Product code string is empty.
Production serial number is empty.
Procedure completed.
```

Product	is automatically set according to the phone support module which was opened manually, but the flash files cannot be found because the correct data cannot be read from the phone automatically.
Code	must be chosen manually, it determines the correct flash files to be used. Please choose the correct product code (can be seen in the phone type label) from the dropdown list.
Flash Type	must be set to “Phone as Manufactured".

v To continue, click “Start”.

Progress bars and messages on the screen show actions during phone programming, please wait.



SW Update

Product: RM-1

Code: 0516982: Scandinavia1

Image File: C:\Program Files\Nokia\Phoenix\products\RM-1\RM1_2.043915_B4.C0R

PPM File: C:\Program Files\Nokia\Phoenix\products\RM-1\RM1_2.043915.v07

Content File:

Adsp File:

Ape Variant

Ape Userdisk:

Flash Type: ○ Restore User Phone ● Phone as Manufactured

Current Status: Programming 7%

Total Process: Flashing Procedure 39%

Output:

```
Elapsed time: 13s
Elapsed time: 24s
Elapsed time: 34s
Elapsed time: 45s
Target erasing completed
Next target programming
Elapsed time: 63s
```

Programming is completed when “Flashing Completed” message is displayed.

The product type designator and MCU SW version are displayed at the bottom of the screen.

vi Close the *SW Update* window and then from the File menu, choose Close product.

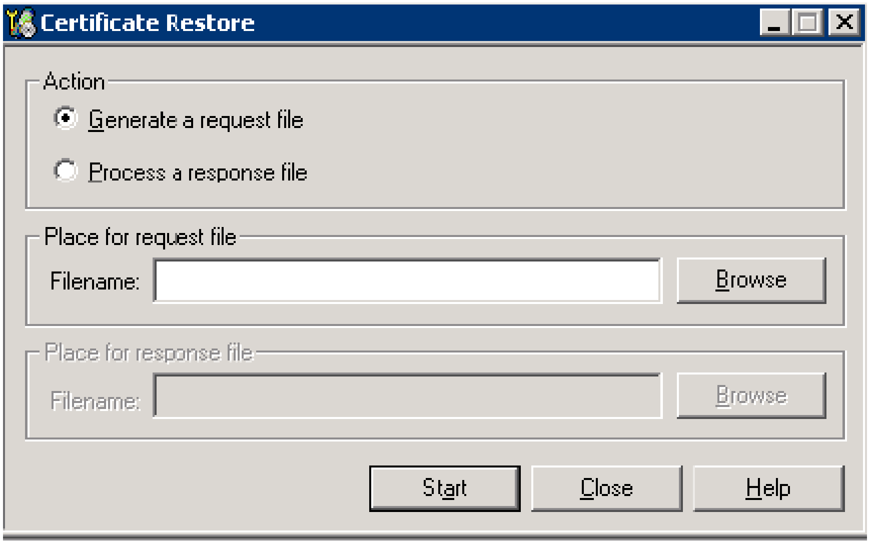
2. Create a Request file.

For this procedure, you must supply +12 V to CU-4 Control Unit from an external power supply.

i To connect the phone with Phoenix, choose File –> Scan Product.

ii From the Tools menu, choose "Certificate Restore".

iii To choose a location for the request file to be saved, click “Browse”.



Certificate Restore

Action

● Generate a request file

○ Process a response file

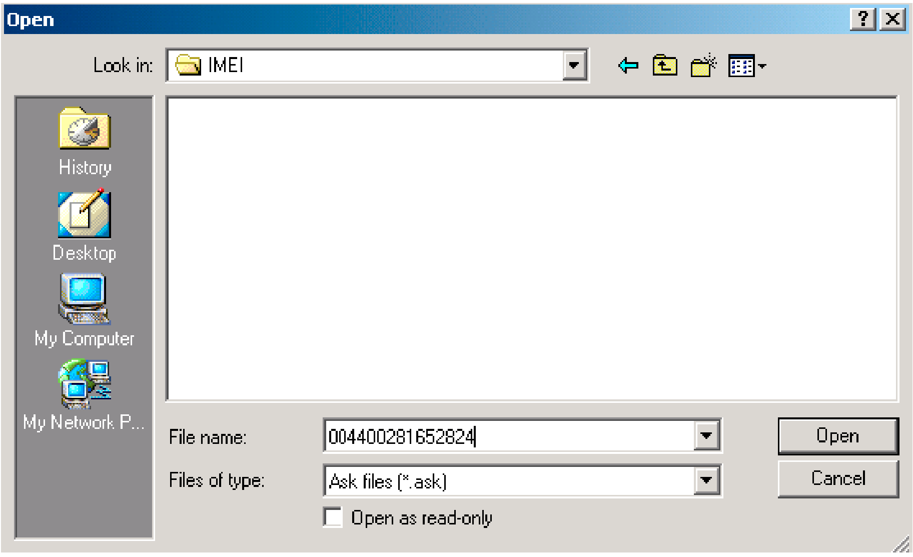
Place for request file

Filename:

Place for response file

Filename:

iv Name the file so that you can easily identify it, and click Open.

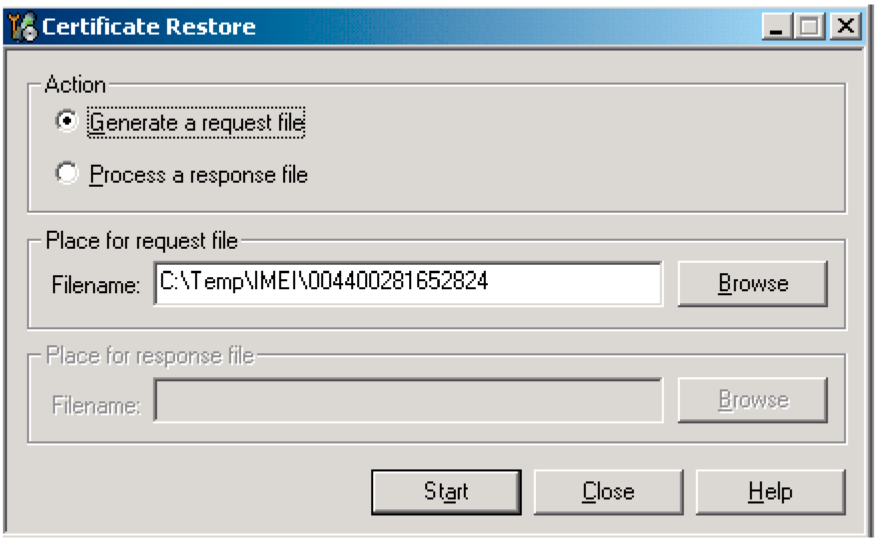

Open
Look in:
IMEI
History
Desktop
My Computer
My Network P...
Open
Cancel

File name: 004400281652824

Files of type: Ask files (*.ask)

☐ Open as read-only

The name of the file and its location are shown.


Certificate Restore
Action
Browse
Place for response file
Filename:
Browse
Start
Close
Help

● Generate a request file

○ Process a response file

Place for request file

Filename: C:\Temp\IMEI\004400281652824

v To create the file, click “Start” .

vi When the request file for Certificate Restore has been created, send it to Nokia as an e-mail attachment.

3. Restore Certificate.

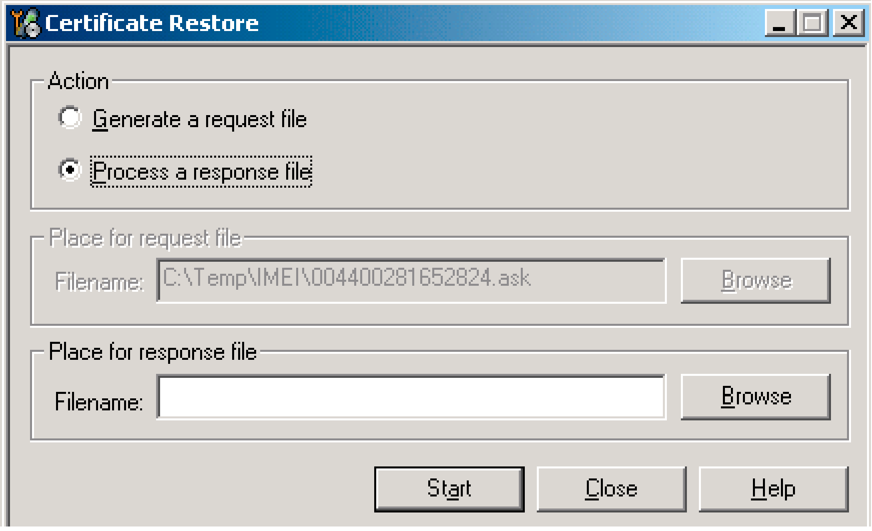
For this procedure, you must supply +12 V to CU-4 Control Unit from an external power supply.

i Save the reply file sent by Nokia to your computer.

ii Start Phoenix service software.

iii From the File menu, choose Scan Product.

iv From the Tools menu, choose "Certificate Restore" and select “Process a response file” in the Action pane.



Certificate Restore

Action
○ Generate a request file
● Process a response file

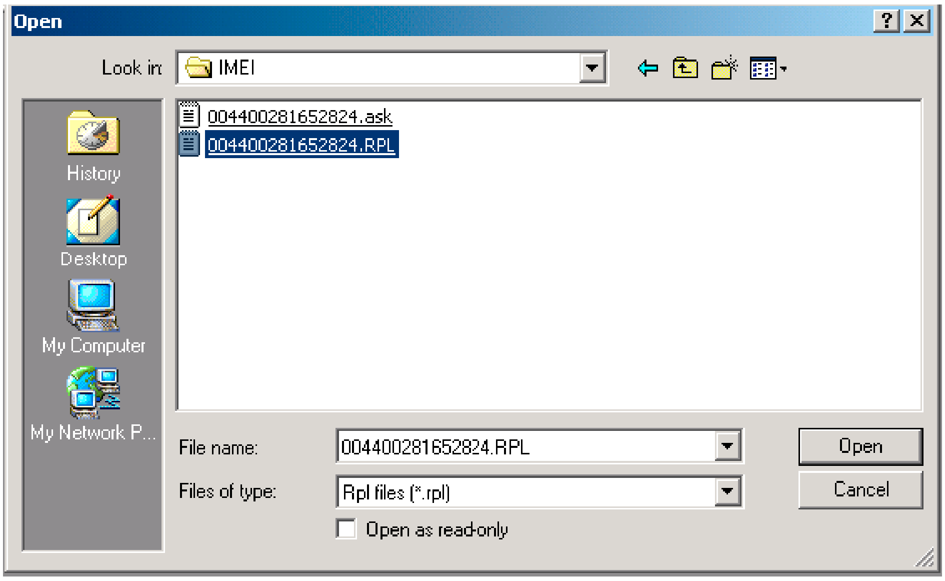
Place for request file
Filename: C:\Temp\IMEI\004400281652824.ask

Place for response file
Filename:

Browse
Browse
Start
Close
Help

v To choose the location where response file is saved, click “Browse”.

vi Click "Open".



Open

Look in: IMEI

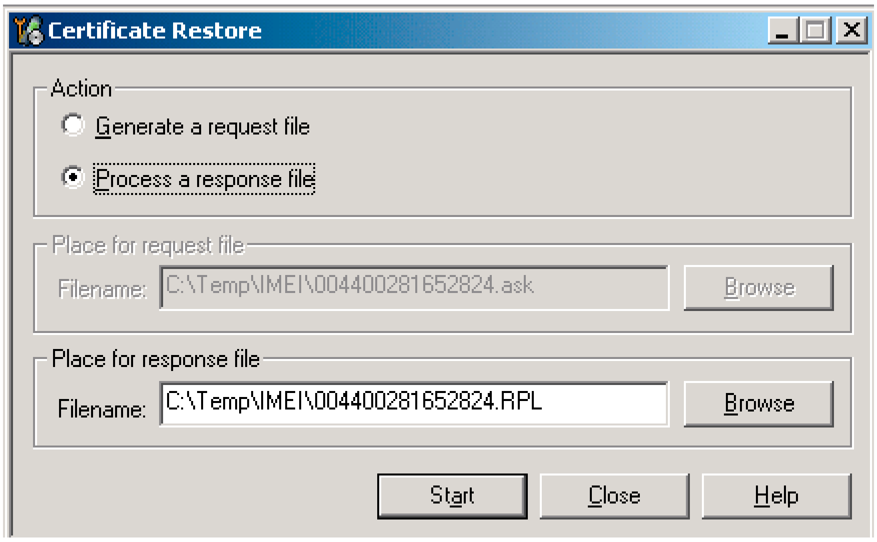
004400281652824.ask
004400281652824.RPL

File name: 004400281652824.RPL
Files of type: Rpl files (*.rpl)
☐ Open as read-only

History
Desktop
My Computer
My Network P...
Open
Cancel

The name of the file and the path where it is located are shown.

vii To write the file to phone, click “Start”.



Action

○ Generate a request file

● Process a response file

Place for request file

Filename: C:\Temp\IMEI\004400281652824.ask

Place for response file

Filename: C:\Temp\IMEI\004400281652824.RPL

Next action

After a successful rewrite, the phone must be retuned completely by using Phoenix tuning functions.

Note: CARRY OUT ALL TUNINGS (BASEBAND, RF, UI)!

Display module troubleshooting

General instructions for display troubleshooting

The first step is to verify with a working display that the fault is not on the display module itself. The display module cannot be repaired.

The second step is to check that the cellular engine is working normally. This can be done by connecting the phone to a docking station and starting Phoenix service software. With the help of Phoenix read the phone information to check that also application engine is functioning normally (you should be able to read the APE ID).

After these checks proceed to the display troubleshooting flowcharts. Use the Display Test tool in Phoenix to find the detailed fault mode.

Operating modes of the display

Display is in a normal mode when the phone is in active use.

Display is in a partial idle mode when the phone is in the screen saver mode.

The operating modes of the display can be controlled with the help of Phoenix.

Table 10 Display module troubleshooting cases

Display blank	There is no image on the display. Display looks the same when the phone is on as it does when the phone is off. The backlight can be on in some cases.
Image on the display not correct	Image on the display can be corrupted or part of the image can be missing. If part of image is missing change the display module. If the image is otherwise corrupted, follow the appropriate troubleshooting diagram.

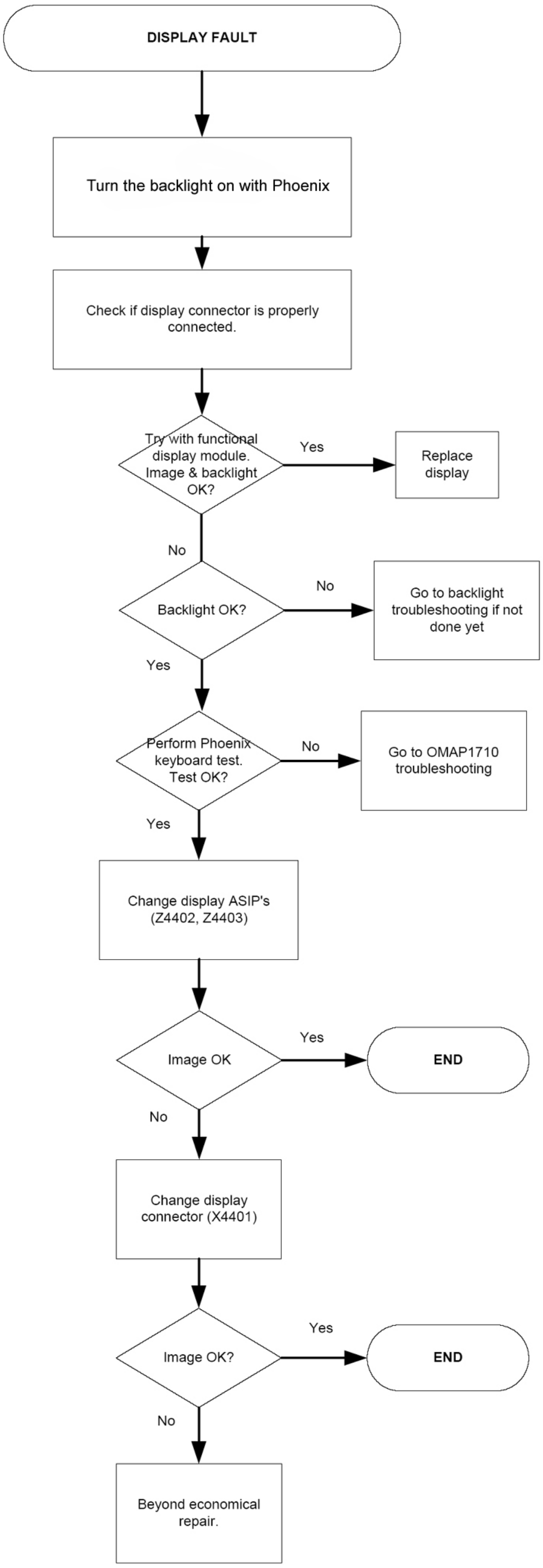
Backlight dim or not working at all	Backlight LED components are inside the display module. Backlight failure can also be in the connector or in the backlight power source in the main engine of the phone. Backlight is also controlled automatically by the ambient light sensor. This means that in case the display is working (image OK) but the backlight is not, follow the Display and keyboard backlight troubleshooting (Page 6–37).
Visual defects (pixel)	Pixel defects can be checked by controlling the display with Phoenix. Use both colours, black and white, on a full screen. The display may have some random pixel defects that are acceptable for this type of display. The criteria when pixel defects are regarded as a display failure, resulting in a replacement of the display, are presented the table below.

Table 11 Pixel defects

Item		White dot defect				Black dot defect	Total
1	Defect counts	R	G	B	White Dot Total	1	1
		1	1	1	1		
2	Combined defect counts	Not allowed. Two single dot defects that are within 5 mm of each other should be interpreted as combined dot defect.					

Note: Blinking pixels are not allowed in normal operating temperatures and light conditions.

Display fault troubleshooting


DISPLAY FAULT
Turn the backlight on with Phoenix
Check if display connector is properly connected.
Try with functional display module. Image & backlight OK?
Yes
Replace display
No
Backlight OK?
No
Go to backlight troubleshooting if not done yet
Yes
Perform Phoenix keyboard test. Test OK?
No
Go to OMAP1710 troubleshooting
Yes
Change display ASIP's (Z4402, Z4403)
Image OK
Yes
END
No
Change display connector (X4401)
Image OK?
Yes
END
No
Beyond economical repair.

Display and keyboard backlight troubleshooting

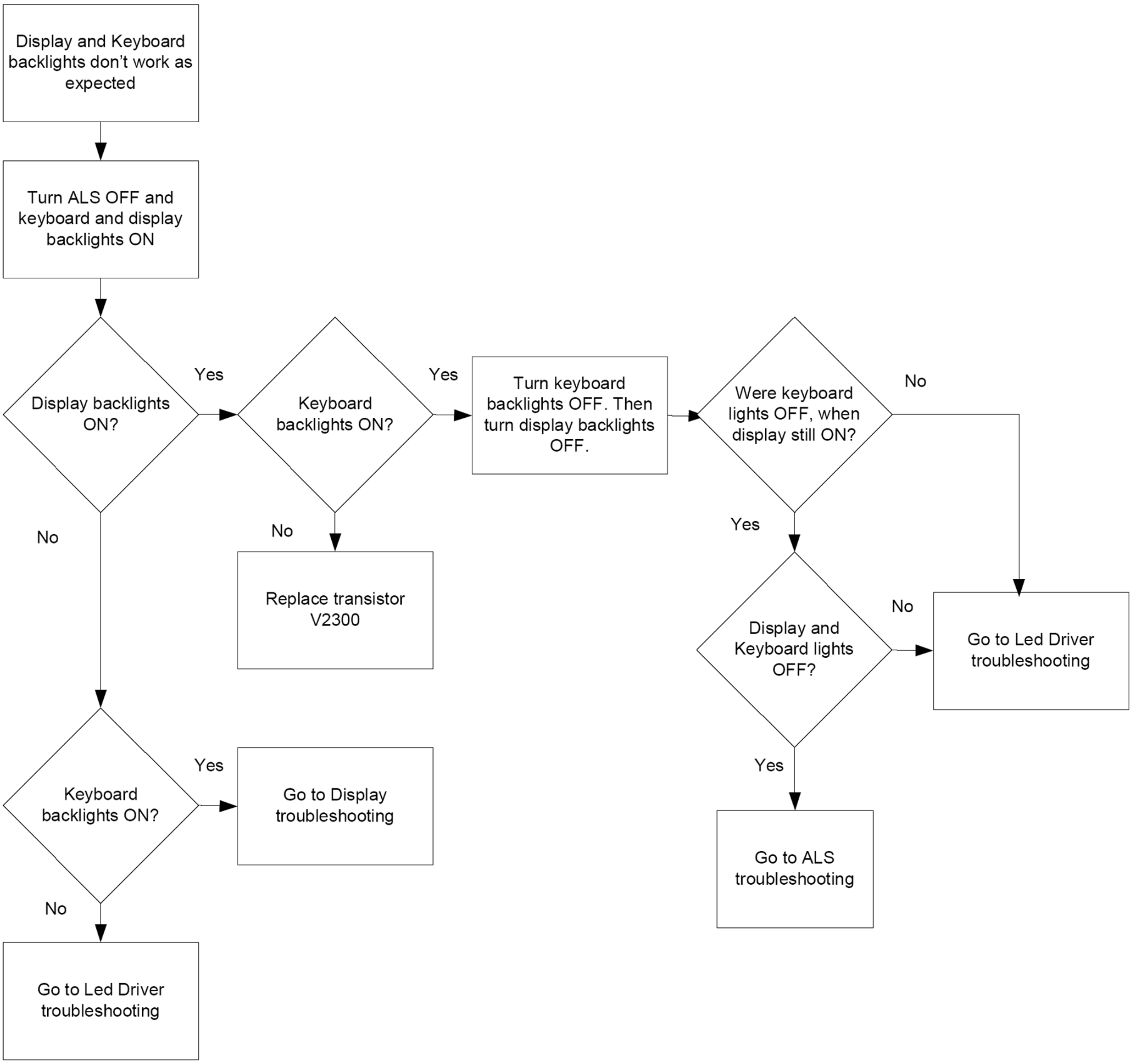
Context

The device has one LED driver that provides current for both display and keyboard backlights.

Keyboard backlights are turned ON only in dark conditions. This is controlled by the Ambient Light Sensor (ALS). Also the brightness of the display is adjusted by the ambient light sensor.

You can enable/disable ALS with the help of Phoenix service software.

Display brightness can be adjusted manually, if ALS is disabled. If the ambient light sensor is enabled, it adjusts the display brightness automatically.


Display and Keyboard backlights don't work as expected
Turn ALS OFF and keyboard and display backlights ON
Display backlights ON?
Yes
Keyboard backlights ON?
Yes
Turn keyboard backlights OFF. Then turn display backlights OFF.
Were keyboard lights OFF, when display still ON?
No
No
No
Replace transistor V2300
Yes
Display and Keyboard lights OFF?
No
Go to Led Driver troubleshooting
Keyboard backlights ON?
Yes
Go to Display troubleshooting
Yes
Go to ALS troubleshooting
No
Go to Led Driver troubleshooting

ALS troubleshooting

Context

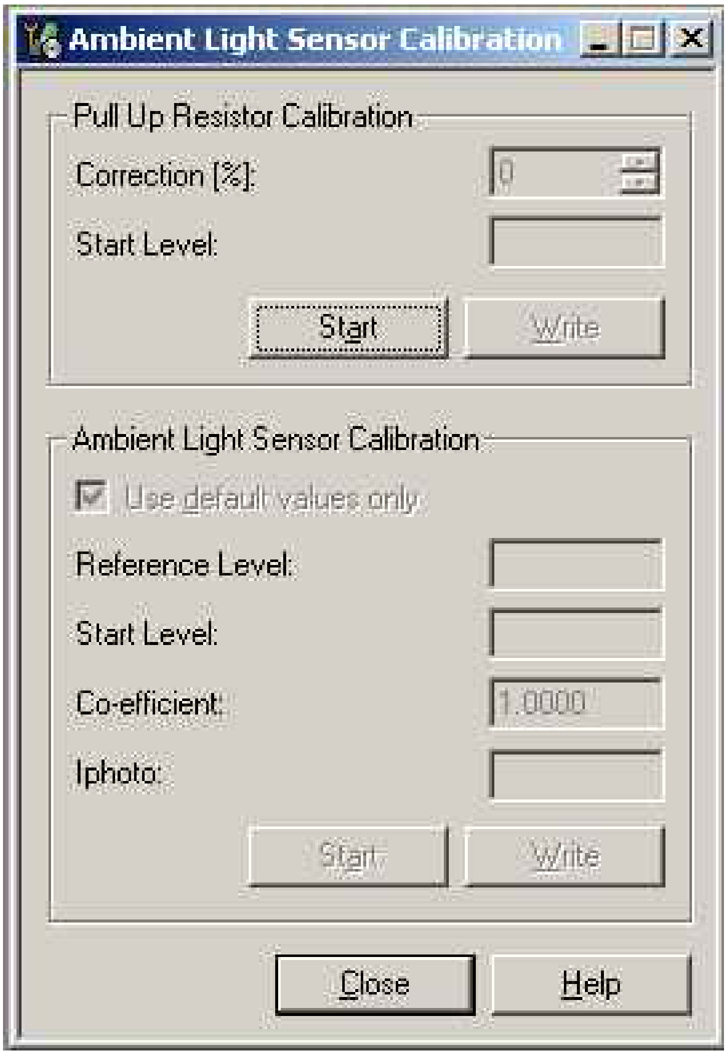
If a phototransistor is broken, replace it with a typical phototransistor. The phototransistor has to be also replaced, if calibration values are lost by some other reason (e.g. after replacing the NOR memory chip D3000).

If the phototransistor is changed, the calibration value in the phone memory has to be changed to the default value ‘1’.

Make sure that you have completed Display and keypad backlight troubleshooting (Page 6–37) first before starting ALS troubleshooting.

Here are some hints for ALS troubleshooting; the following troubleshooting diagram refers to these:

- Phoenix LED control tool also shows you luminance. The correct luminance in darkness is <20lx, and in office environment 100-2000lx. The luminance value depends strongly on the light source and the angle of the phone, so these values are only a rough guideline.
- LED driver control voltage measurement points can be found from LED driver troubleshooting (Page 6–41) section. When backlight brightness is set to 100%, both GENOUT-signals are low, and enable PWM is 100%.
- Phoenix has an ambient light sensor calibration tool for changing calibration values. The pull-up resistor calibration is done first:
  a Cover the light guide (upper part of the A Cover).
  b Click 'Start' and 'Write'.
  c Manually change the ambient light sensor value to the default value. There is no special tool for this, but you have to perform calibration normally and then set the "Co-efficient" result to '1' before writing it to the phone memory.


Ambient Light Sensor Calibration
Pull Up Resistor Calibration
Start
Write
Ambient Light Sensor Calibration
Start
Write
Close
Help

Correction [%]: 0

Start Level:

☑ Use default values only

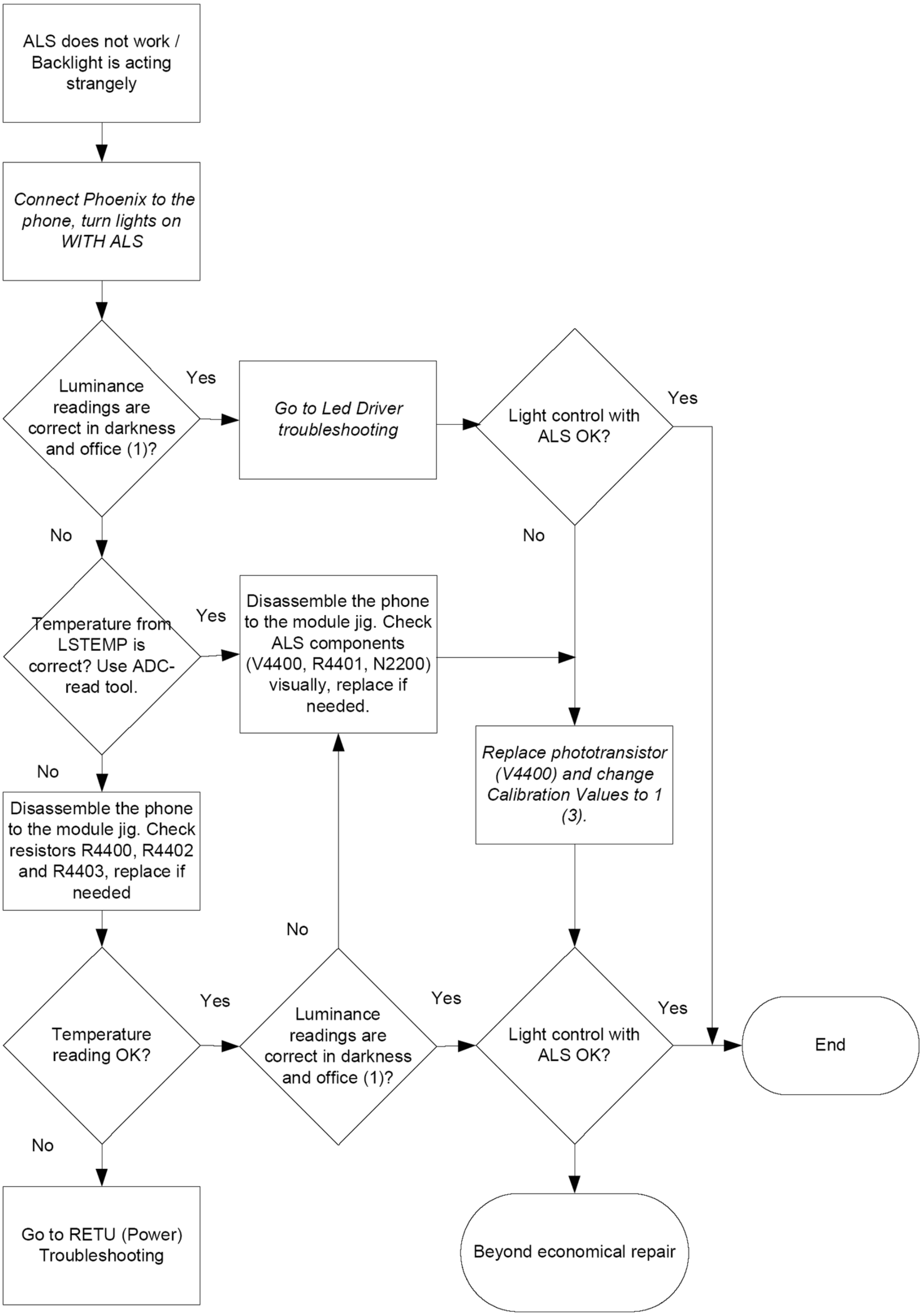
Reference Level:

Start Level:

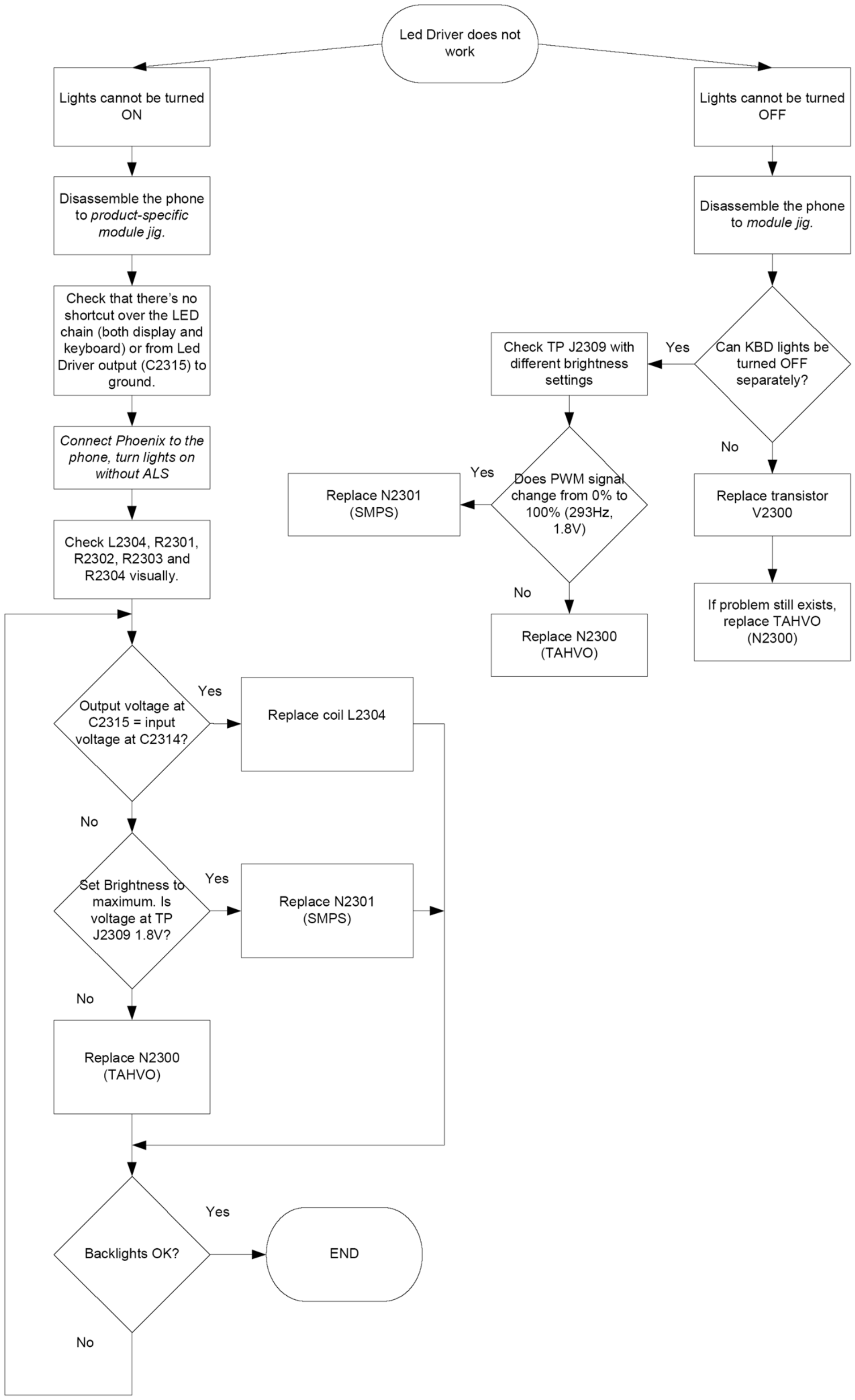
Co-efficient: 1.0000

Iphoto:

Figure 54 Ambient Light Sensor Calibration window


ALS does not work / Backlight is acting strangely
Connect Phoenix to the phone, turn lights on WITH ALS
Luminance readings are correct in darkness and office (1)?
Yes
No
Go to Led Driver troubleshooting
Light control with ALS OK?
Yes
No
Temperature from LSTEMP is correct? Use ADC-read tool.
Yes
No
Disassemble the phone to the module jig. Check ALS components (V4400, R4401, N2200) visually, replace if needed.
Replace phototransistor (V4400) and change Calibration Values to 1 (3).
Disassemble the phone to the module jig. Check resistors R4400, R4402 and R4403, replace if needed
No
Temperature reading OK?
Yes
No
Luminance readings are correct in darkness and office (1)?
Yes
Light control with ALS OK?
Yes
End
Go to RETU (Power) Troubleshooting
Beyond economical repair

LED driver troubleshooting


Led Driver does not work
Lights cannot be turned ON
Disassemble the phone to *product-specific module jig.*
Check that there's no shortcut over the LED chain (both display and keyboard) or from Led Driver output (C2315) to ground.
Connect Phoenix to the phone, turn lights on without ALS
Check L2304, R2301, R2302, R2303 and R2304 visually.
Output voltage at C2315 = input voltage at C2314?
Yes
Replace coil L2304
No
Set Brightness to maximum. Is voltage at TP J2309 1.8V?
Yes
Replace N2301 (SMPS)
No
Replace N2300 (TAHVO)
Backlights OK?
Yes
END
No
Lights cannot be turned OFF
Disassemble the phone to *module jig.*
Can KBD lights be turned OFF separately?
Yes
Check TP J2309 with different brightness settings
Does PWM signal change from 0% to 100% (293Hz, 1.8V)
Yes
Replace N2301 (SMPS)
No
Replace N2300 (TAHVO)
No
Replace transistor V2300
If problem still exists, replace TAHVO (N2300)

Bluetooth troubleshooting

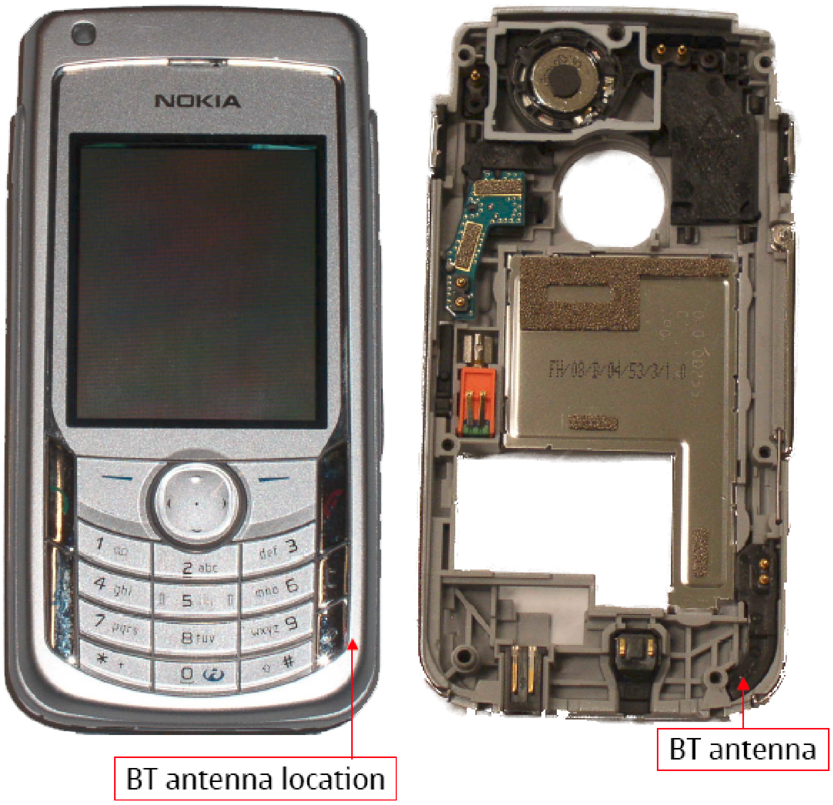
Introduction to Bluetooth troubleshooting

There are two main Bluetooth problems that can occur:

Problem	Description
Detachment of the BT antenna.	This would most likely happen if the device has been dropped repeatedly to the ground. It could cause the BT antenna to become loose or partially detached from the PWB. (see the following figures for details about BT antenna HW and Mechanics)
A malfunction in the BT ASIC, BB ASICs or Phone's BT SMD components.	This is unpredictable and could have many causes i.e. SW or HW related.

The main issue is to find out if the problem is related to the BT antenna or related to the BT system or the phone's BB and then replace/fix the faulty component.

Location of the BT antenna



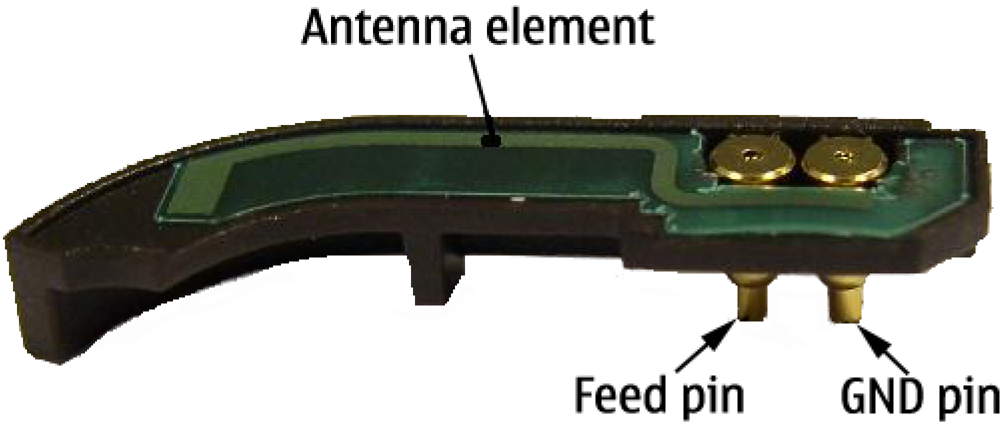
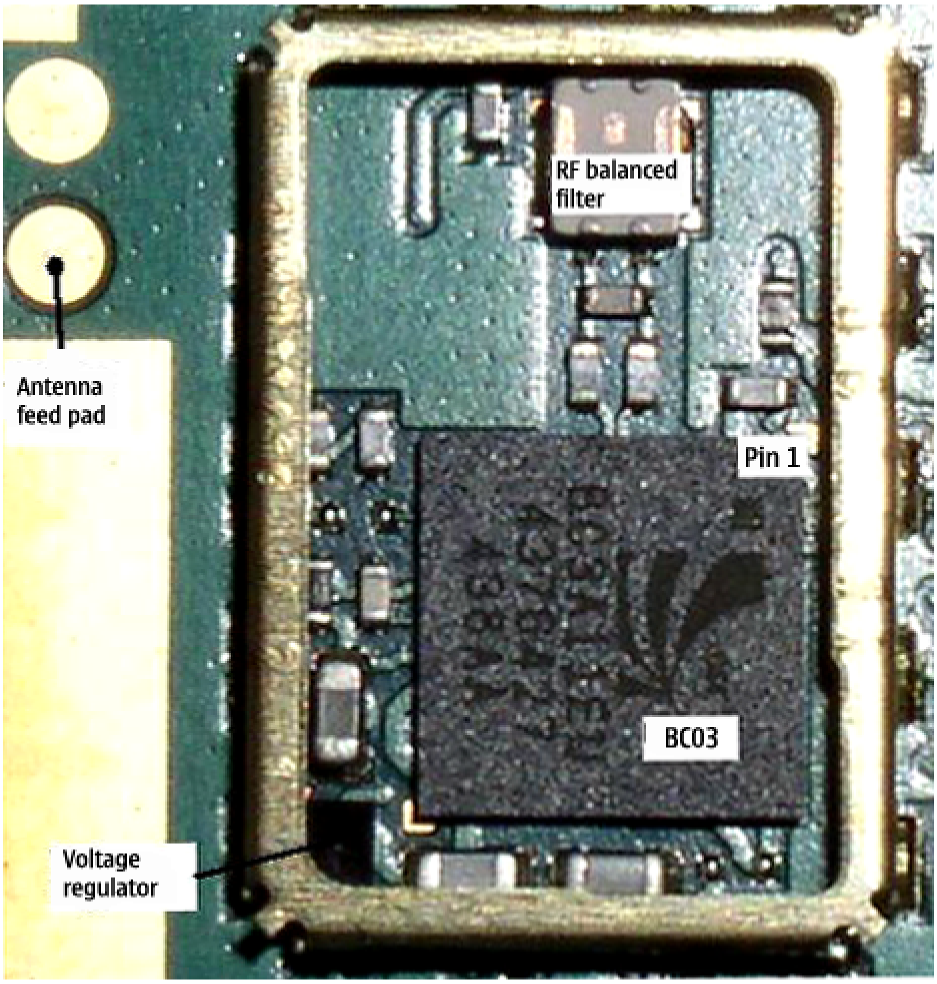

Antenna element
Feed pin
GND pin

Figure 55 Antenna element

Bluetooth layout


RF balanced filter
Antenna feed pad
Pin 1
BC03
Voltage regulator

See Also

- Bluetooth settings for Phoenix (Page 6–44)
- Bluetooth self tests in Phoenix (Page 6–44)
- Bluetooth BER failure troubleshooting (Page 6–46)
- Bluetooth audio failure troubleshooting (Page 6–48)

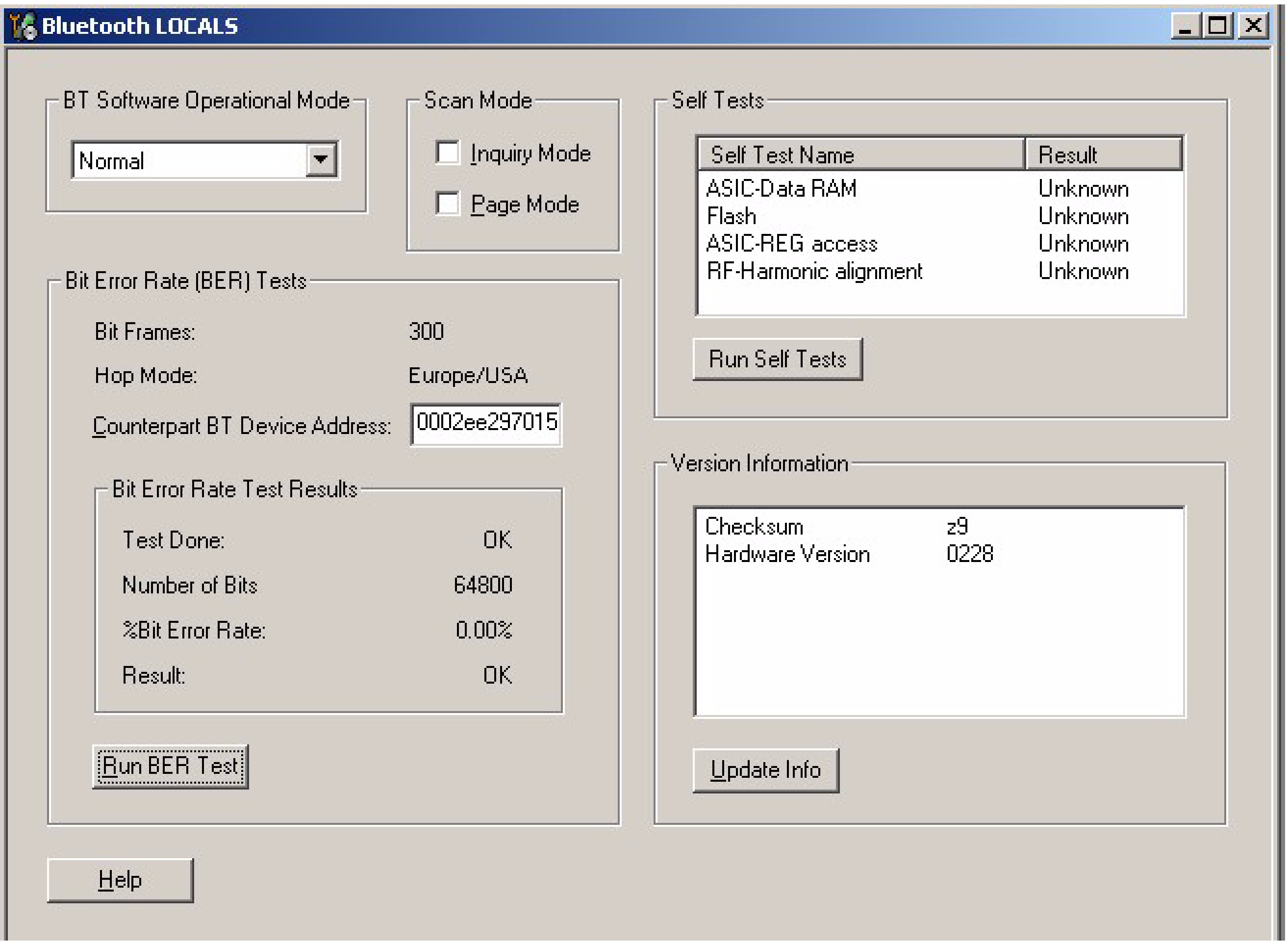
Bluetooth settings for Phoenix

Steps

1. Start Phoenix service software.
2. From the File menu, choose Open Product, and then choose the correct type designator from the Product list.
3. Connect the phone to a docking station in the local mode.
4. From the Testing menu, choose Bluetooth LOCALS.
5. Locate JBT-9’s serial number (12 digits) found in the type label on the back of JBT-9.
6. In the Bluetooth LOCALS window, write the 12-digit serial number on the "Counterpart BT Device Address" line.

   This needs to be done only once provided that JBT-9 is not changed.
7. Place the JBT-9 box near (within 10 cm) the BT antenna and click Run BER Test.

Results



BT Software Operational Mode: Normal

Scan Mode
☐ Inquiry Mode
☐ Page Mode

Bit Error Rate (BER) Tests
Bit Frames: 300
Hop Mode: Europe/USA
Counterpart BT Device Address: 0002ee297015

Bit Error Rate Test Results
Test Done: OK
Number of Bits 64800
%Bit Error Rate: 0.00%
Result: OK

Self Tests

Self Test Name	Result
ASIC-Data RAM	Unknown
Flash	Unknown
ASIC-REG access	Unknown
RF-Harmonic alignment	Unknown

Version Information

Checksum	z9
Hardware Version	0228

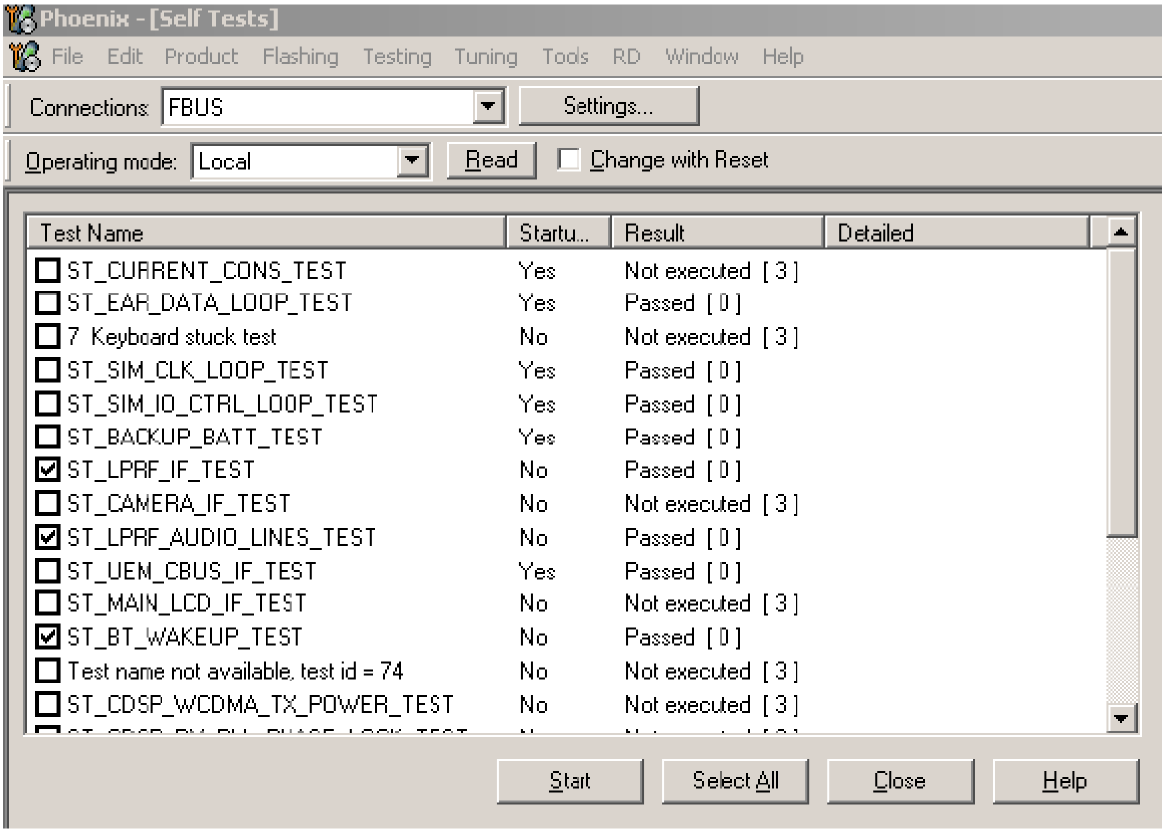
Figure 56 Phoenix settings for Bluetooth troubleshooting

Bluetooth self tests in Phoenix

Steps

1. Start Phoenix service software.

2. From the File menu, choose Open Product, and then choose the correct type designator from the Product list.
3. Connect the phone to a docking station in the local mode.
4. From the Testing menu, choose Self Tests.
5. Choose the following Bluetooth related tests:
    - ST_LPRF_IF_TEST
    - ST_LPRF_AUDIO_LINES_TEST
    - ST_BT_WAKEUP_TEST
6. To run the tests, click Start.


Phoenix - [Self Tests]
File
Edit
Product
Flashing
Testing
Tuning
Tools
RD
Window
Help
Settings...
Read
Start
Select All
Close
Help

Connections: FBUS

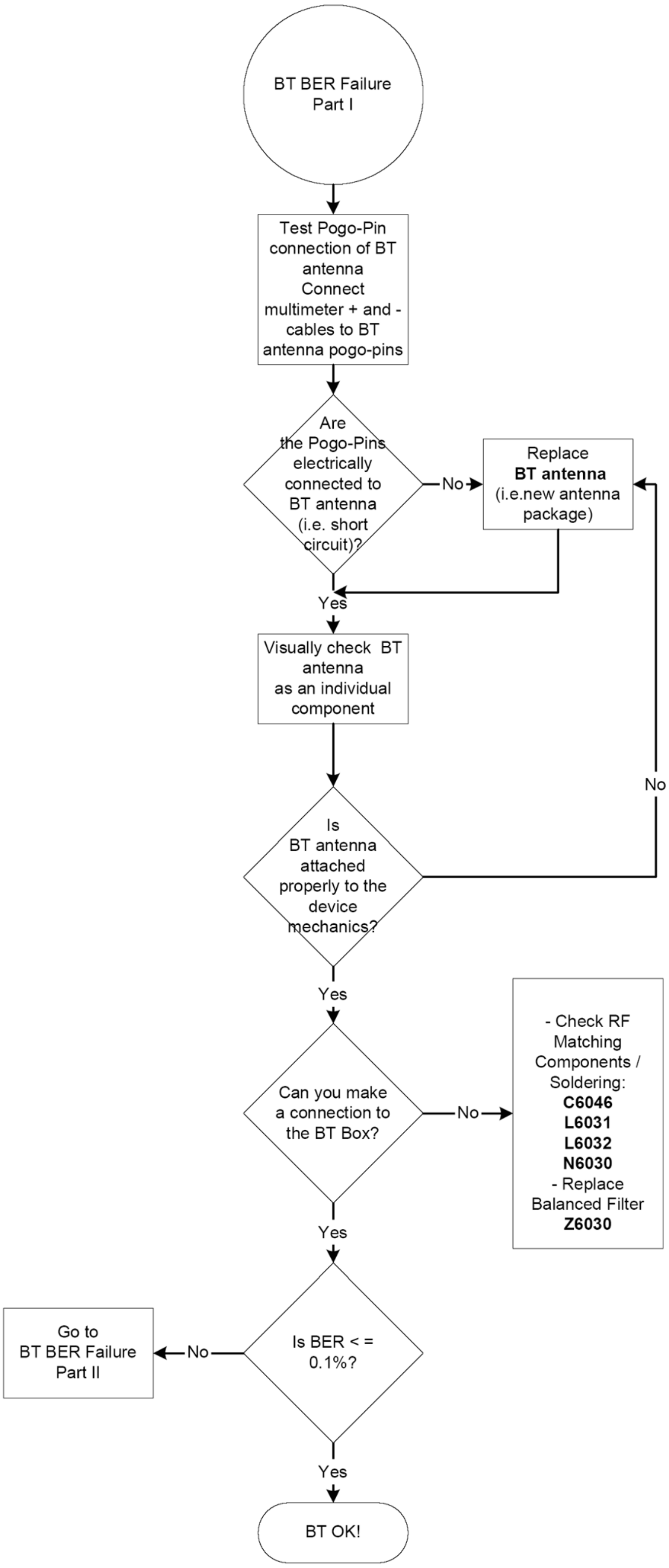
Operating mode: Local

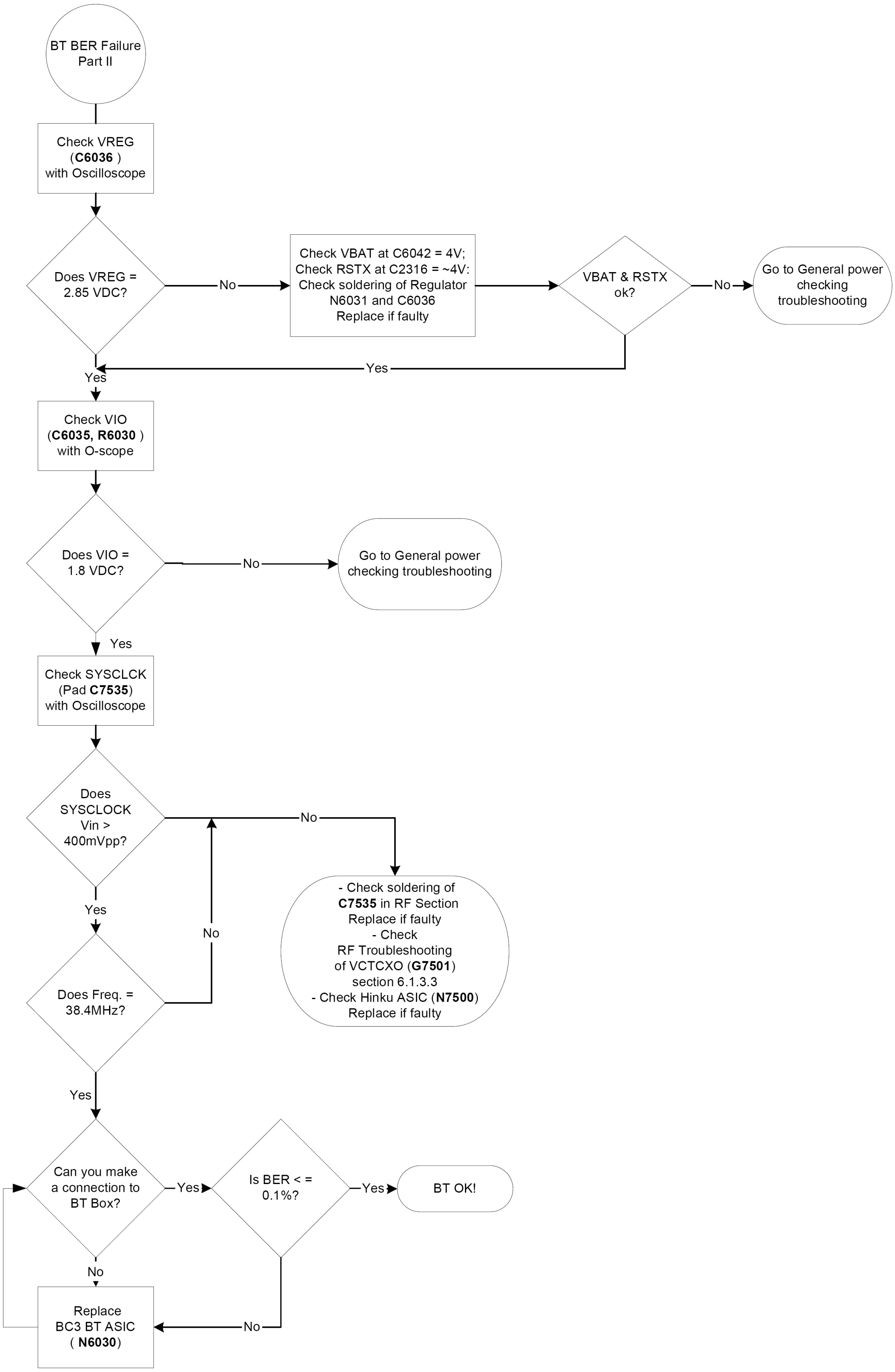
☐ Change with Reset

Test Name	Startu...	Result	Detailed
☐ ST_CURRENT_CONS_TEST	Yes	Not executed [3]	
☐ ST_EAR_DATA_LOOP_TEST	Yes	Passed [0]	
☐ 7 Keyboard stuck test	No	Not executed [3]	
☐ ST_SIM_CLK_LOOP_TEST	Yes	Passed [0]	
☐ ST_SIM_IO_CTRL_LOOP_TEST	Yes	Passed [0]	
☐ ST_BACKUP_BATT_TEST	Yes	Passed [0]	
☑ ST_LPRF_IF_TEST	No	Passed [0]	
☐ ST_CAMERA_IF_TEST	No	Not executed [3]	
☑ ST_LPRF_AUDIO_LINES_TEST	No	Passed [0]	
☐ ST_UEM_CBUS_IF_TEST	Yes	Passed [0]	
☐ ST_MAIN_LCD_IF_TEST	No	Not executed [3]	
☑ ST_BT_WAKEUP_TEST	No	Passed [0]	
☐ Test name not available, test id = 74	No	Not executed [3]	
☐ ST_CDSP_WCDMA_TX_POWER_TEST	No	Not executed [3]	

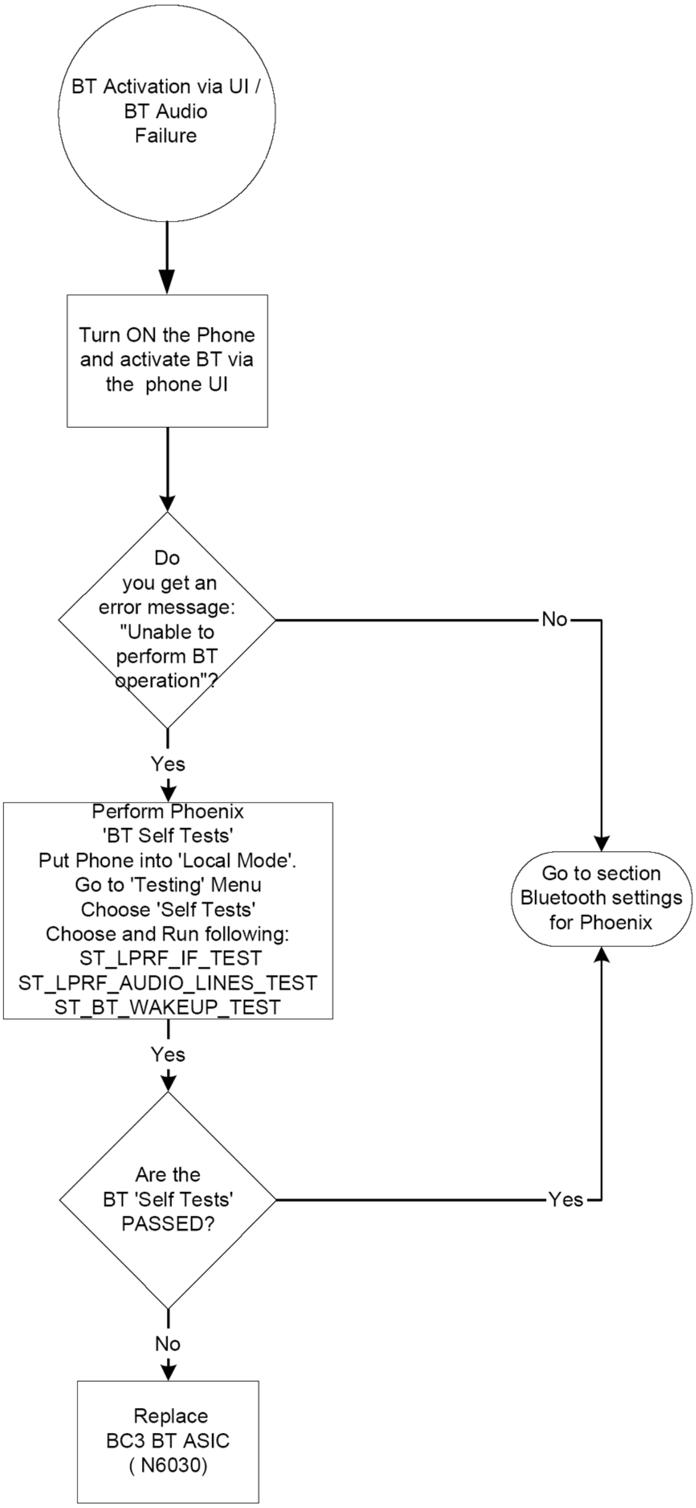
Figure 57 Bluetooth self tests in Phoenix

Bluetooth BER failure troubleshooting


BT BER Failure
Part I
Test Pogo-Pin connection of BT antenna
Connect multimeter + and - cables to BT antenna pogo-pins
Are the Pogo-Pins electrically connected to BT antenna (i.e. short circuit)?
No
Replace **BT antenna** (i.e.new antenna package)
Yes
Visually check BT antenna as an individual component
Is BT antenna attached properly to the device mechanics?
No
Yes
Can you make a connection to the BT Box?
No
- Check RF Matching Components / Soldering:
C6046
L6031
L6032
N6030
- Replace Balanced Filter
Z6030
Yes
Is BER < = 0.1%?
No
Go to BT BER Failure Part II
Yes
BT OK!


BT BER Failure Part II
Check VREG (C6036) with Oscilloscope
Does VREG = 2.85 VDC?
No
Check VBAT at C6042 = 4V; Check RSTX at C2316 = ~4V: Check soldering of Regulator N6031 and C6036 Replace if faulty
VBAT & RSTX ok?
No
Go to General power checking troubleshooting
Yes
Yes
Check VIO (C6035, R6030) with O-scope
Does VIO = 1.8 VDC?
No
Go to General power checking troubleshooting
Yes
Check SYSCLCK (Pad C7535) with Oscilloscope
Does SYSCLOCK Vin > 400mVpp?
No
- Check soldering of C7535 in RF Section Replace if faulty - Check RF Troubleshooting of VCTCXO (G7501) section 6.1.3.3 - Check Hinku ASIC (N7500) Replace if faulty
Yes
No
Does Freq. = 38.4MHz?
Yes
Can you make a connection to BT Box?
Yes
Is BER < = 0.1%?
Yes
BT OK!
No
Replace BC3 BT ASIC (N6030)
No

BT audio failure troubleshooting


BT Activation via UI / BT Audio Failure
Turn ON the Phone and activate BT via the phone UI
Do you get an error message: "Unable to perform BT operation"?
No
Yes
Perform Phoenix 'BT Self Tests' Put Phone into 'Local Mode'. Go to 'Testing' Menu Choose 'Self Tests' Choose and Run following: ST_LPRF_IF_TEST ST_LPRF_AUDIO_LINES_TEST ST_BT_WAKEUP_TEST
Go to section Bluetooth settings for Phoenix
Yes
Are the BT 'Self Tests' PASSED?
Yes
No
Replace BC3 BT ASIC (N6030)

Audio troubleshooting

Audio troubleshooting test instructions

Differential external earpiece and internal earpiece outputs can be measured either with a single-ended or a differential probe.

When measuring with a single-ended probe each output is measured against the ground.

Internal handsfree output is measured using a current probe, if a special low-pass filter designed for measuring a digital amplifier is not available. Note also that when using a current probe, the input signal frequency must be set to 2kHz.

The input signal for each loop test can be either single-ended or differential.

Required equipment

The following equipment is needed for the tests:

- Oscilloscope
- Function generator (sine waveform)
- Current probe (Internal handsfree DPMA output measurement)
- Phoenix service software
- Battery voltage 3.7V

Test procedure

Audio can be tested using the Phoenix audio routings option. Three different audio loop paths can be activated:

- External microphone to Internal earpiece
- External microphone to Internal handsfree speaker
- Internal microphone to External earpiece

Each audio loop sets routing from the specified input to the specified output enabling a quick in-out test. Loop path gains are fixed and they cannot be changed using Phoenix. Correct pins and signals for each test are presented in the following table.

Phoenix audio loop tests and test results

The results presented in the table apply when no accessory is connected and battery voltage is set to 3.7V.

Earpiece, internal microphone and speaker are in place during measurement. Applying a headset accessory during measurement causes a significant drop in measured quantities.

The gain values presented in the table apply for a differential output vs. single-ended/differential input.

Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Differential output voltage [mVp-p]	Output DC level [V]	Output current [mA]
External Mic to External Earpiece	XMICP and GND	HSEAR R P, HSEAR R N and GND	-2.9	1000	720	1.2	NA
		HSEAR P, HSEAR N and GND					
	XMICN and GND	HSEAR R P, HSEAR R N and GND					
		HSEAR P, HSEAR N and GND					

Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Differential output voltage [mVp-p]	Output DC level [V]	Output current [mA]
External Mic to Internal Earpiece	XMICP and GND	EarP and GND	-4.5	1000	600	1.2	NA
		EarN and GND					
	XMICN and GND	EarP and GND					
		EarN and GND					
External Mic to Internal handsfree	XMICP and GND	B2102 pads	-5	1000	560	0	25mA (calc.)
	XMICN and GND	B2102 pads					
Internal Mic to External Earpiece	B2100 (OUT/GND)	HSEAR R P, HSEAR R N and GND	22.7	100	1360	1.2	NA
		HSEAR P, HSEAR N and GND					
		HSEAR R P, HSEAR R N and GND					
		HSEAR P, HSEAR N and GND					

Measurement data

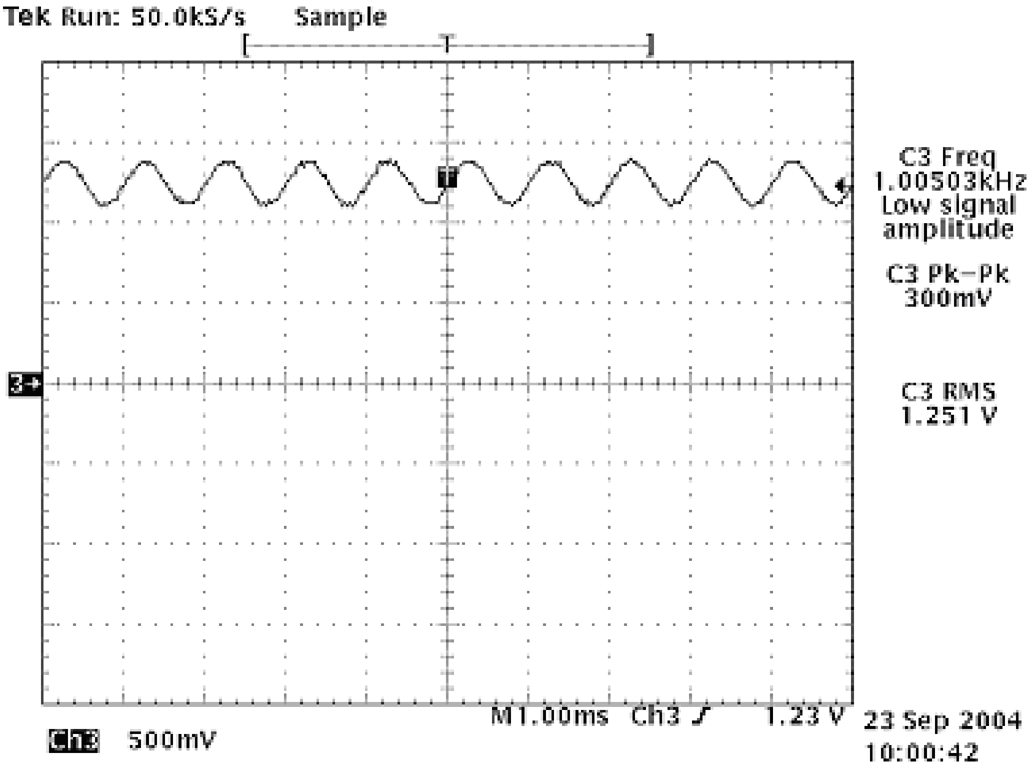
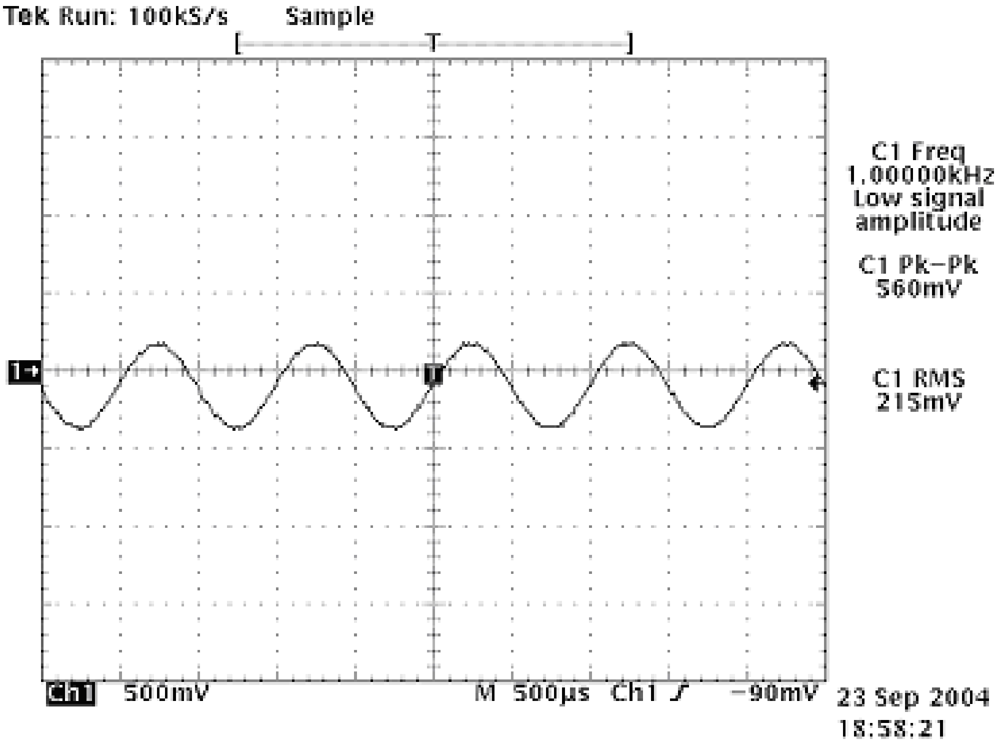


Figure 58 Single-ended output waveform of the Ext_in_HP_out measurement when earpiece is connected.



Legend

If a special low-pass filter designed for measuring digital amplifiers is unavailable, the measurement must be performed with a current probe and the input signal frequency must be 2kHz.

Figure 59 Differential output waveform of the Ext_in_IHF_out out loop measurement when speaker is connected.

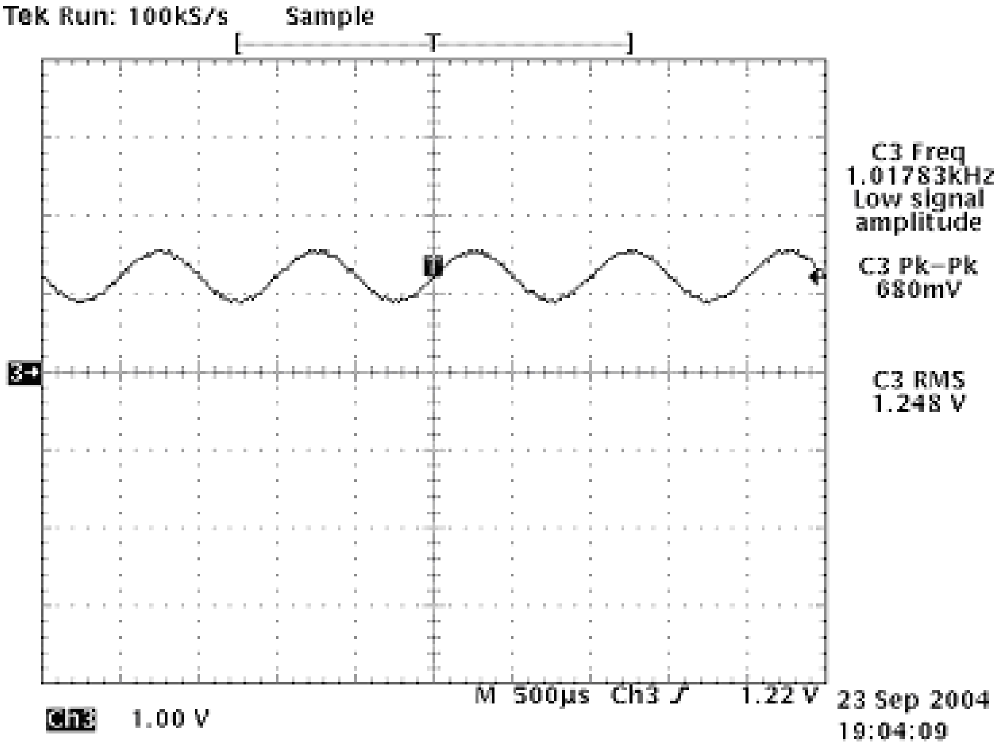
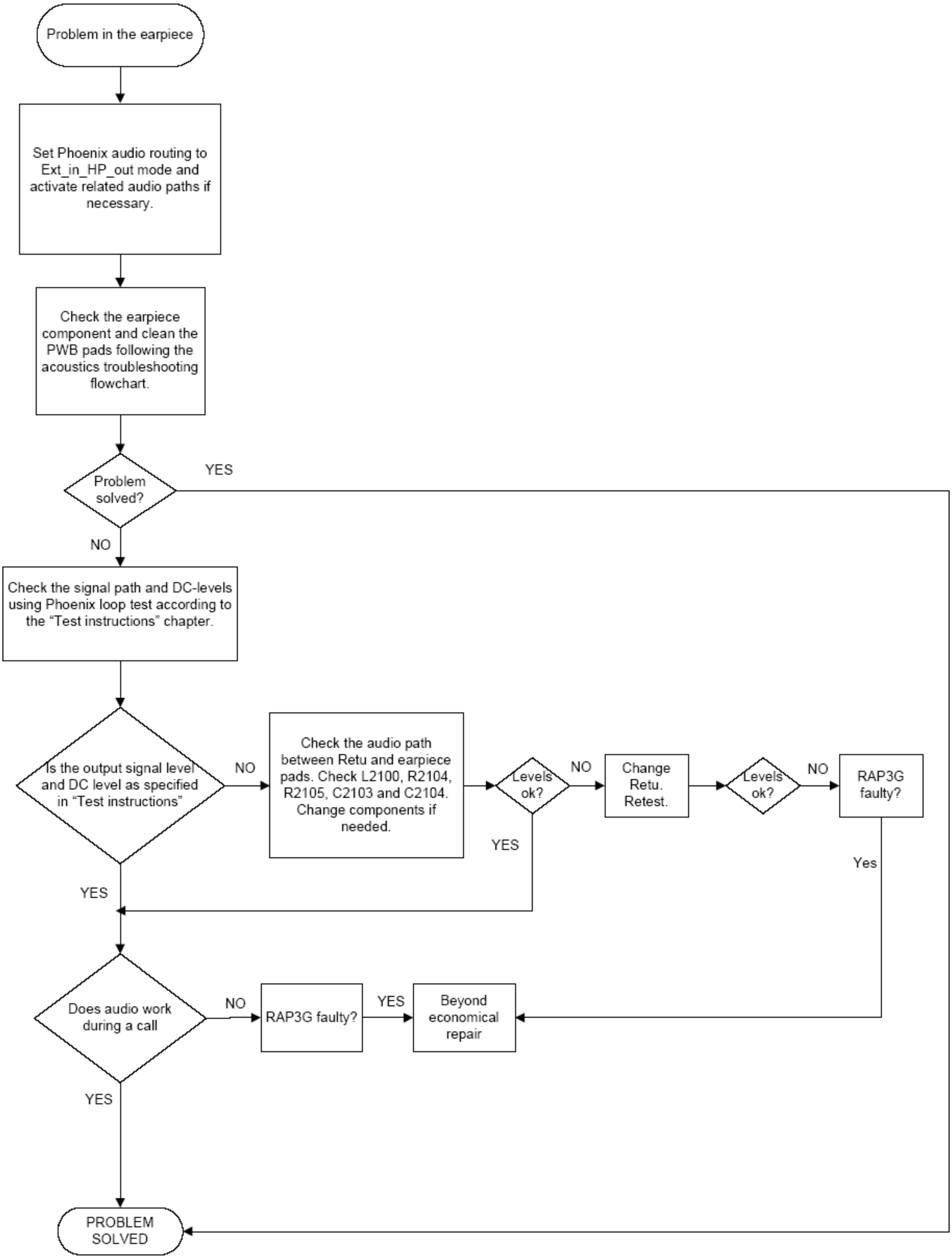


Figure 60 Single-ended output waveform of the HP_in_Ext_out loop when microphone is connected.

Internal earpiece troubleshooting

Before you begin

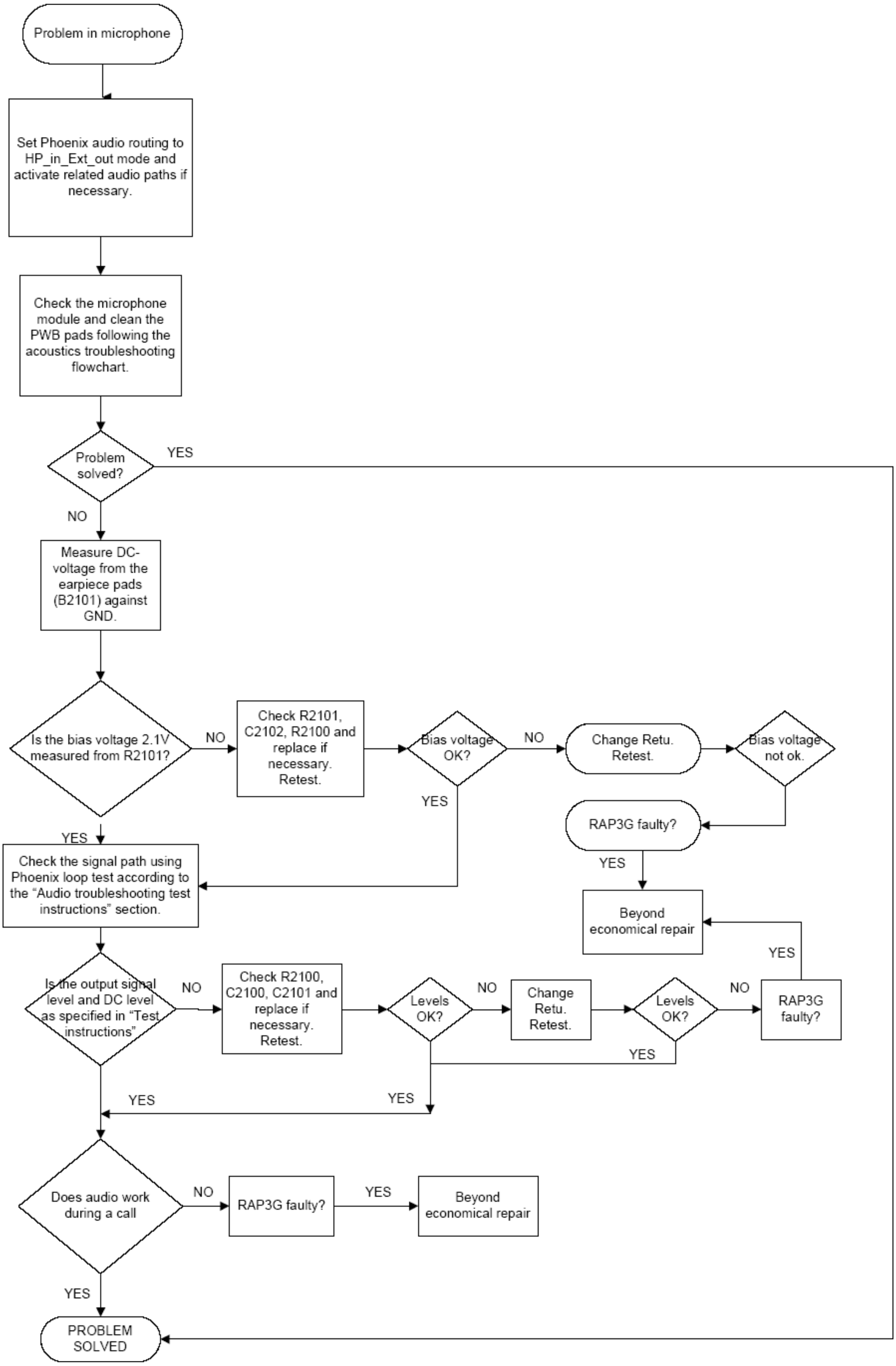
Familiarize yourself with the Audio troubleshooting test instructions (Page 6–48).


Problem in the earpiece
Set Phoenix audio routing to Ext_in_HP_out mode and activate related audio paths if necessary.
Check the earpiece component and clean the PWB pads following the acoustics troubleshooting flowchart.
Problem solved?
YES
NO
Check the signal path and DC-levels using Phoenix loop test according to the "Test instructions" chapter.
Is the output signal level and DC level as specified in "Test instructions"
NO
Check the audio path between Retu and earpiece pads. Check L2100, R2104, R2105, C2103 and C2104. Change components if needed.
Levels ok?
NO
Change Retu. Retest.
Levels ok?
NO
RAP3G faulty?
Yes
YES
YES
Does audio work during a call
NO
RAP3G faulty?
YES
Beyond economical repair
YES
PROBLEM SOLVED

Internal microphone troubleshooting

Before you begin

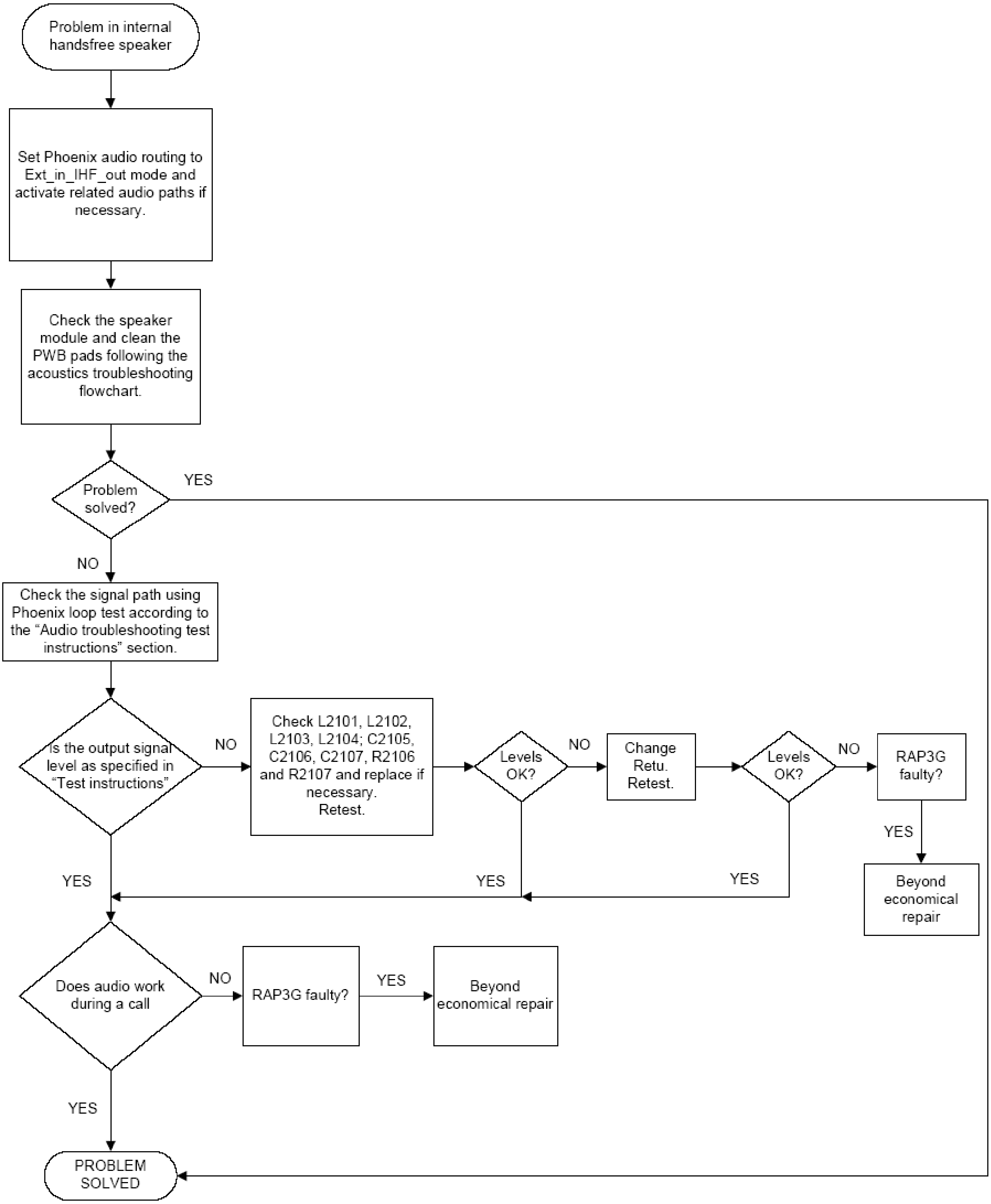
Familiarize yourself with the Audio troubleshooting test instructions (Page 6–48).


Problem in microphone
Set Phoenix audio routing to HP_in_Ext_out mode and activate related audio paths if necessary.
Check the microphone module and clean the PWB pads following the acoustics troubleshooting flowchart.
Problem solved?
YES
NO
Measure DC-voltage from the earpiece pads (B2101) against GND.
Is the bias voltage 2.1V measured from R2101?
NO
Check R2101, C2102, R2100 and replace if necessary. Retest.
Bias voltage OK?
NO
Change Retu. Retest.
Bias voltage not ok.
YES
RAP3G faulty?
YES
Beyond economical repair
YES
Check the signal path using Phoenix loop test according to the "Audio troubleshooting test instructions" section.
Is the output signal level and DC level as specified in "Test instructions"
NO
Check R2100, C2100, C2101 and replace if necessary. Retest.
Levels OK?
NO
Change Retu. Retest.
Levels OK?
NO
RAP3G faulty?
YES
YES
YES
YES
Does audio work during a call
NO
RAP3G faulty?
YES
Beyond economical repair
YES
PROBLEM SOLVED

IHF troubleshooting

Before you begin

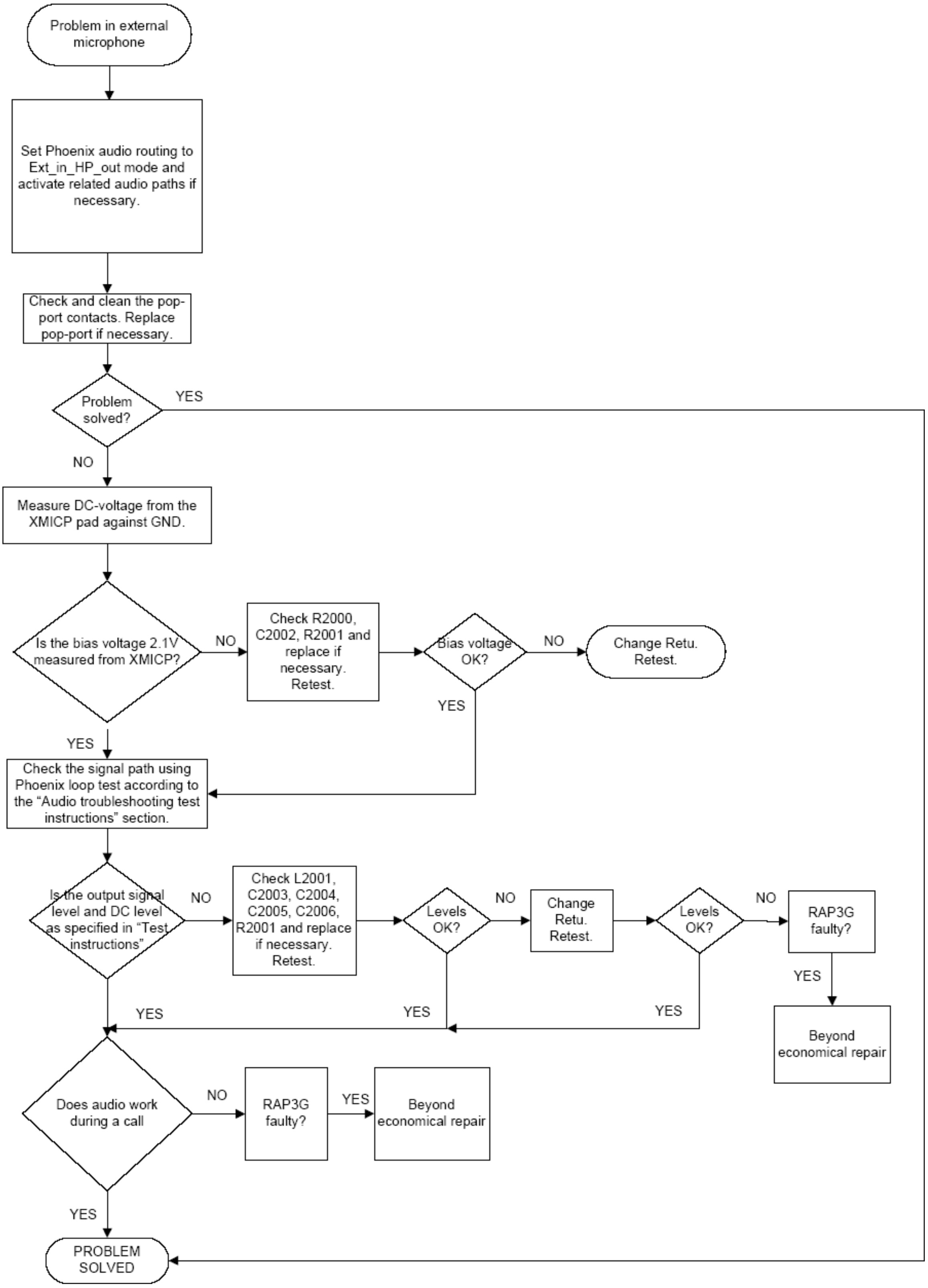
Familiarize yourself with the Audio troubleshooting test instructions (Page 6–48).


Problem in internal handsfree speaker
Set Phoenix audio routing to Ext_in_IHF_out mode and activate related audio paths if necessary.
Check the speaker module and clean the PWB pads following the acoustics troubleshooting flowchart.
Problem solved?
YES
NO
Check the signal path using Phoenix loop test according to the "Audio troubleshooting test instructions" section.
Is the output signal level as specified in "Test instructions"
NO
Check L2101, L2102, L2103, L2104; C2105, C2106, C2107, R2106 and R2107 and replace if necessary. Retest.
Levels OK?
NO
Change Retu. Retest.
Levels OK?
NO
RAP3G faulty?
YES
Beyond economical repair
YES
YES
YES
Does audio work during a call
NO
RAP3G faulty?
YES
Beyond economical repair
YES
PROBLEM SOLVED

External microphone troubleshooting

Before you begin

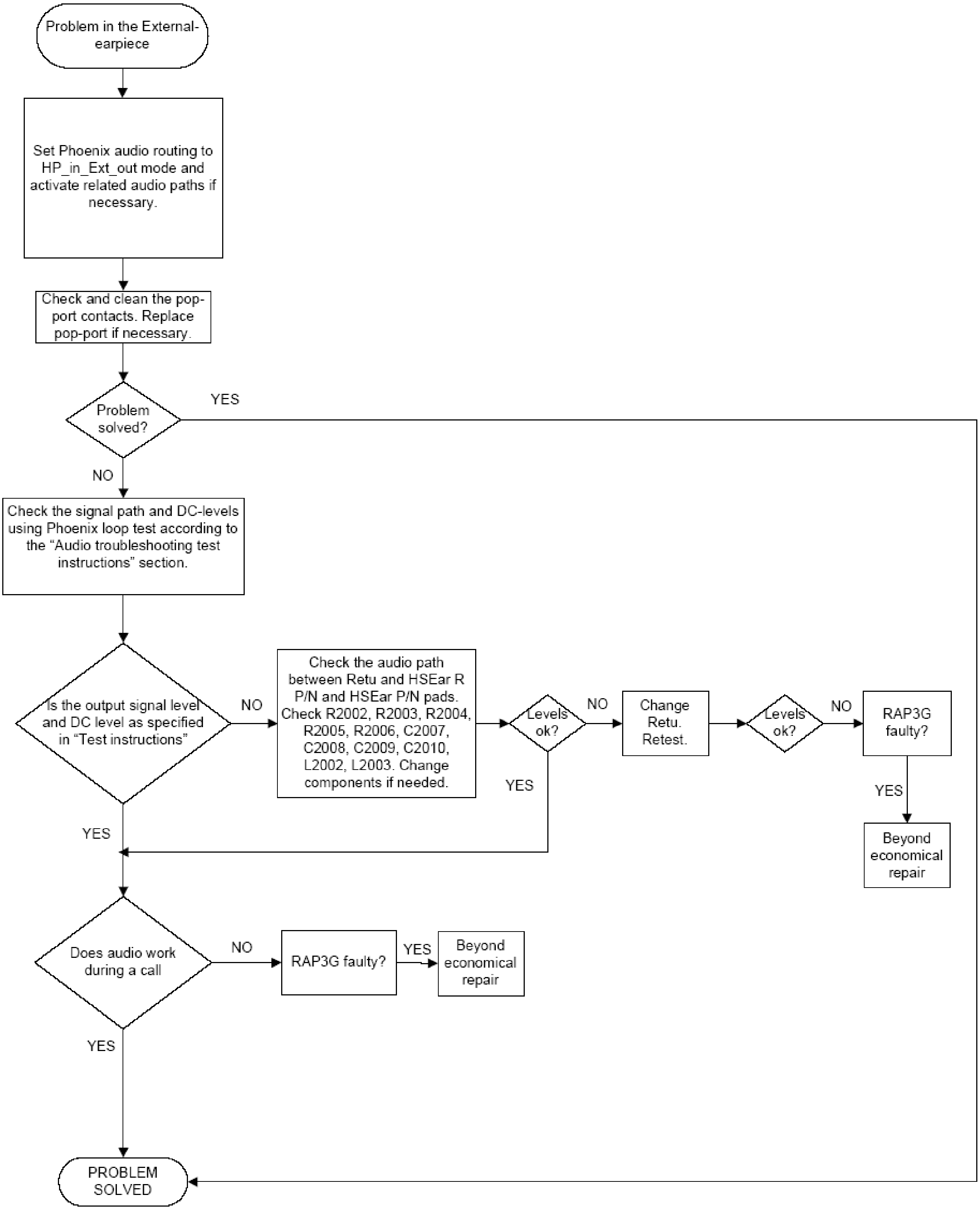
Familiarize yourself with the Audio troubleshooting test instructions (Page 6–48).


Problem in external microphone
Set Phoenix audio routing to Ext_in_HP_out mode and activate related audio paths if necessary.
Check and clean the pop-port contacts. Replace pop-port if necessary.
Problem solved?
YES
NO
Measure DC-voltage from the XMICP pad against GND.
Is the bias voltage 2.1V measured from XMICP?
NO
Check R2000, C2002, R2001 and replace if necessary. Retest.
Bias voltage OK?
NO
Change Retu. Retest.
YES
YES
Check the signal path using Phoenix loop test according to the "Audio troubleshooting test instructions" section.
Is the output signal level and DC level as specified in "Test instructions"
NO
Check L2001, C2003, C2004, C2005, C2006, R2001 and replace if necessary. Retest.
Levels OK?
NO
Change Retu. Retest.
Levels OK?
NO
RAP3G faulty?
YES
Beyond economical repair
YES
YES
YES
Does audio work during a call
NO
RAP3G faulty?
YES
Beyond economical repair
YES
PROBLEM SOLVED

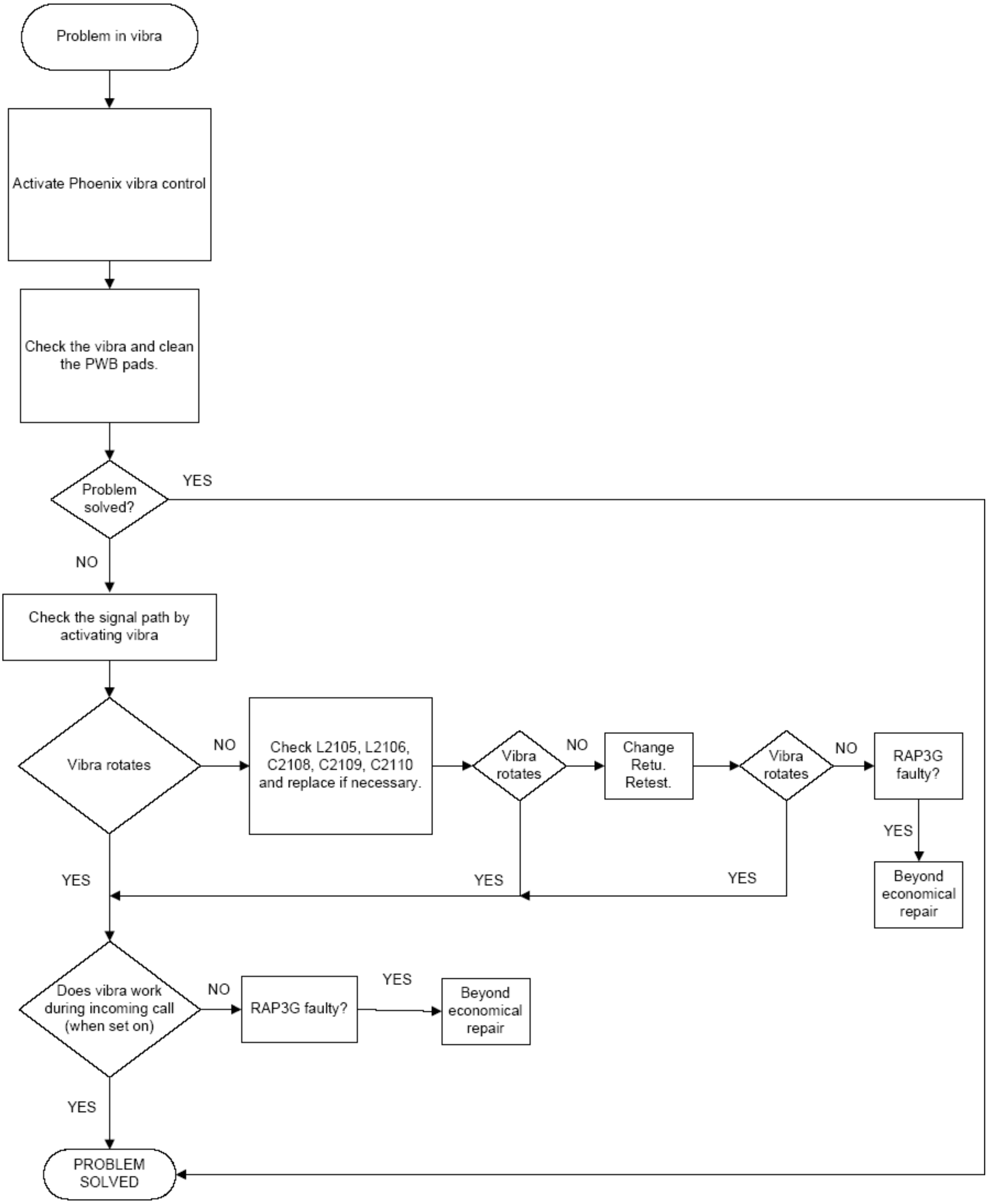
External earpiece troubleshooting

Before you begin

Familiarize yourself with the Audio troubleshooting test instructions (Page 6–48).


Problem in the External-earpiece
Set Phoenix audio routing to HP_in_Ext_out mode and activate related audio paths if necessary.
Check and clean the pop-port contacts. Replace pop-port if necessary.
Problem solved?
YES
NO
Check the signal path and DC-levels using Phoenix loop test according to the "Audio troubleshooting test instructions" section.
Is the output signal level and DC level as specified in "Test instructions"
NO
Check the audio path between Retu and HSEar R P/N and HSEar P/N pads. Check R2002, R2003, R2004, R2005, R2006, C2007, C2008, C2009, C2010, L2002, L2003. Change components if needed.
Levels ok?
NO
Change Retu. Retest.
Levels ok?
NO
RAP3G faulty?
YES
Beyond economical repair
YES
YES
Does audio work during a call
NO
RAP3G faulty?
YES
Beyond economical repair
YES
PROBLEM SOLVED

Vibra troubleshooting


Problem in vibra
Activate Phoenix vibra control
Check the vibra and clean the PWB pads.
Problem solved?
YES
NO
Check the signal path by activating vibra
Vibra rotates
NO
Check L2105, L2106, C2108, C2109, C2110 and replace if necessary.
Vibra rotates
NO
Change Retu. Retest.
Vibra rotates
NO
RAP3G faulty?
YES
Beyond economical repair
YES
YES
YES
Does vibra work during incoming call (when set on)
NO
RAP3G faulty?
YES
Beyond economical repair
YES
PROBLEM SOLVED

Baseband manual tuning guide

Energy management calibration

Before you begin

EM (Energy Management) calibration is performed to calibrate the setting (gain and offset) of AD converters in several channels (that is, **battery voltage**, **BSI**, **battery current**) to get an accurate AD conversion result.

Hardware setup:

- An external power supply is needed.
- Supply 12V DC from an external power supply to CU-4 to power up the phone.
- The phone must be connected to a CU-4 control unit with a product-specific flash adapter.

Steps

1. Switch the phone to the docking station adapter (CU-4 is connected to the adapter).
2. Start Phoenix service software.
3. From the File menu, choose "Scan product".
4. From the Tuning menu, choose "Energy Management Calibration".
5. To show the current values in the phone memory, click "Read", and check that communication between the phone and CU-4 works.
6. Check that the “CU-4 used” check box is checked.
7. Select the item(s) to be calibrated.

   Note: ADC calibration has to be performed before other item(s). However, if all calibrations are selected at the same time, there is no need to perform the ADC calibration first.
8. Click Calibrate.

   The calibration of the selected item(s) is carried out automatically.
9. The candidates for the new calibration values are shown in the “Calculated values” column. If the new calibration values seem to be acceptable (please refer to the following "Calibration value limits" table), click Write to store the new calibration values to the phone permanent memory.

Table 12 Calibration value limits

Parameter	Min.	Max.
ADC Offset	-20	30
ADC Gain	12000	14000
BSI Gain	1100	1300
VBAT Offset	2400	2650
VBAT Gain	19000	23000
IBAT (ICal) Gain	7750	12250

10. Click “Read” and confirm that the new calibration values are stored in the phone memory correctly. If the values are not stored to the phone memory, click "Write" and/or repeat the procedure again.
11. To end the procedure, close the "Energy Management Calibration" window.

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7 — RF Troubleshooting and Manual Tuning Guide

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Introduction to RF troubleshooting

All measurements should be done using:

- spectrum analyser with a high-frequency high-impedance passive probe (LO-/reference frequencies and RF power levels)
- oscilloscope with a 10:1 probe (DC-voltages and low frequency signals)

The RF section of the phone is build around two RF ASICS: Rx ASIC N7500 and Tx ASIC N7501. There is also one PA on board (N7502).

Note: The grounding of the PA module is directly below the PA module. Therefore, it is difficult to check or change the module.

Note: Most RF semiconductors are static discharge sensitive! ESD protection must be taken care of during repair (ground straps and ESD soldering irons). N7501, N7500, PA and SMPS are moisture sensitive, so parts must be pre-baked prior to soldering.

In addition to key components, there are lot of discrete components (resistors, inductors and capacitors) which troubleshooting is done mainly by checking if the soldering of the component is done properly.

Capacitor can be checked for shorts and resistors for value by means of an ohmmeter, but be aware in-circuit measurements should be evaluated carefully.

Keep in mind that all measured voltages or RF levels depicted in the service manual are rough figures. Especially RF levels vary because of different measuring equipment or different grounding of the probe used.

When using an RF probe, use a pair of metallic tweezers to connect the probe ground to the PWB ground as close to the measurement point as possible. If measurements are performed in a product specific module jig then “GND” pads should be used for the probe ground.

For additional RF troubleshooting instructions, see Appendix A. These instructions include descriptions/ instructions for RF self-tests as well as troubleshooting instructions for various fault cases.

RF key component placement

The RF section of the phone is build around two RF ASICs, Rx ASIC N7500 and Tx ASIC N7501.

There is one PA on the board, N7502.

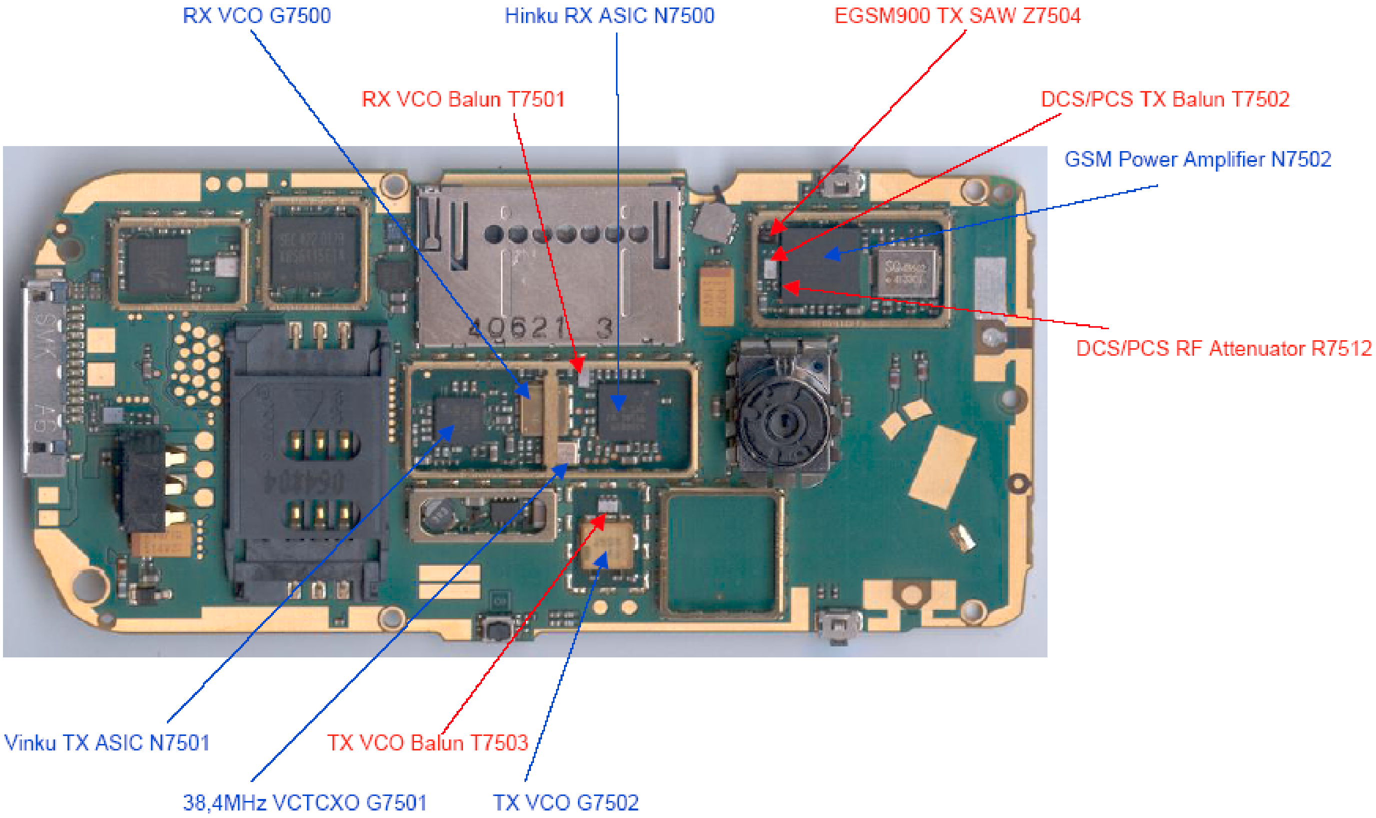

RX VCO G7500
Hinku RX ASIC N7500
EGSM900 TX SAW Z7504
RX VCO Balun T7501
DCS/PCS TX Balun T7502
GSM Power Amplifier N7502
DCS/PCS RF Attenuator R7512
Vinku TX ASIC N7501
TX VCO Balun T7503
38,4MHz VCTCXO G7501
TX VCO G7502

Figure 61 RF key component placement

Fault finding test point locations

Test points for spectrum analyzer

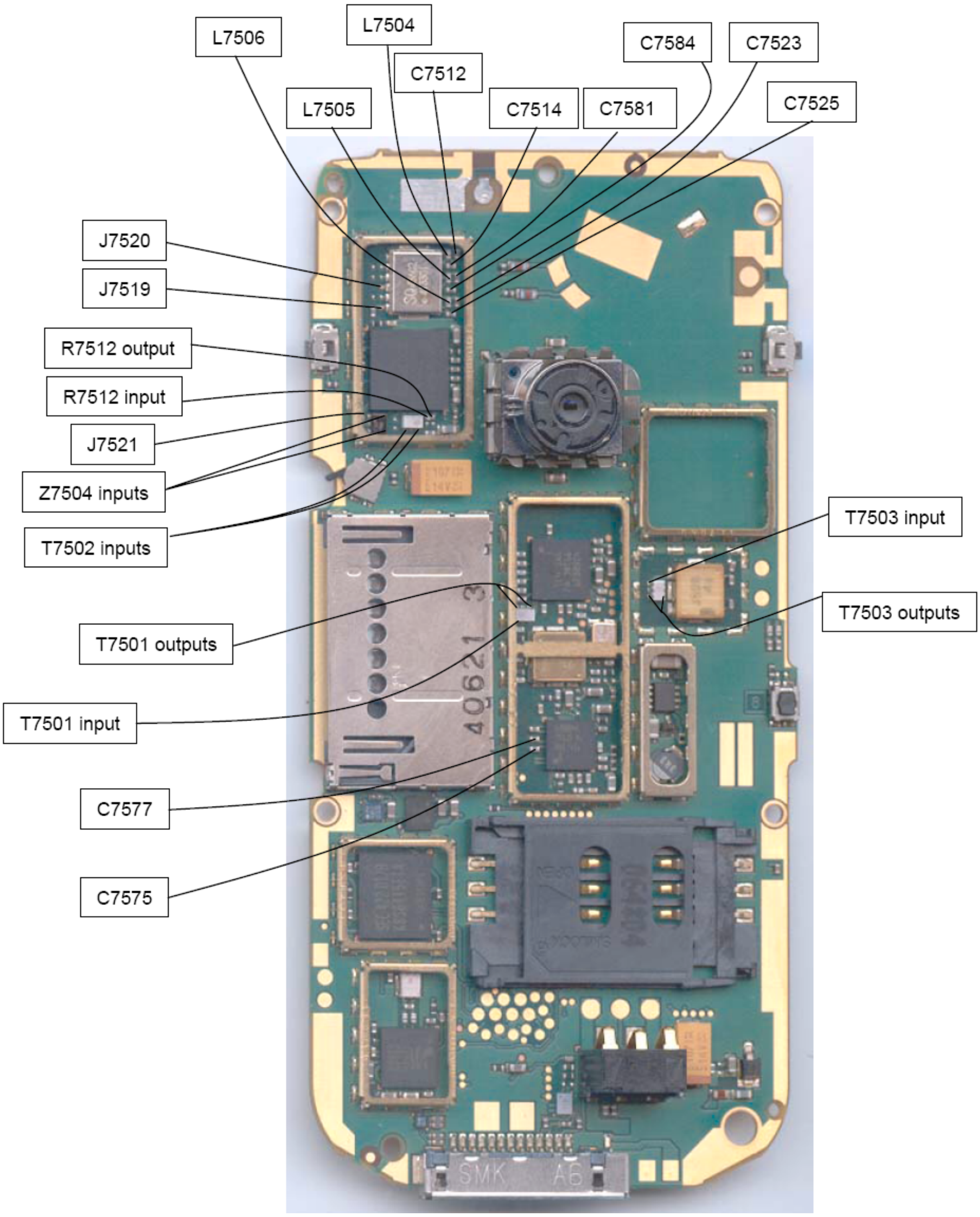

L7506
L7504
C7512
L7505
C7514
C7581
C7584
C7523
C7525
J7520
J7519
R7512 output
R7512 input
J7521
Z7504 inputs
T7502 inputs
T7503 input
T7503 outputs
T7501 outputs
T7501 input
C7577
C7575

Figure 62 Test point locations for spectrum analyzer

Test points for oscilloscope

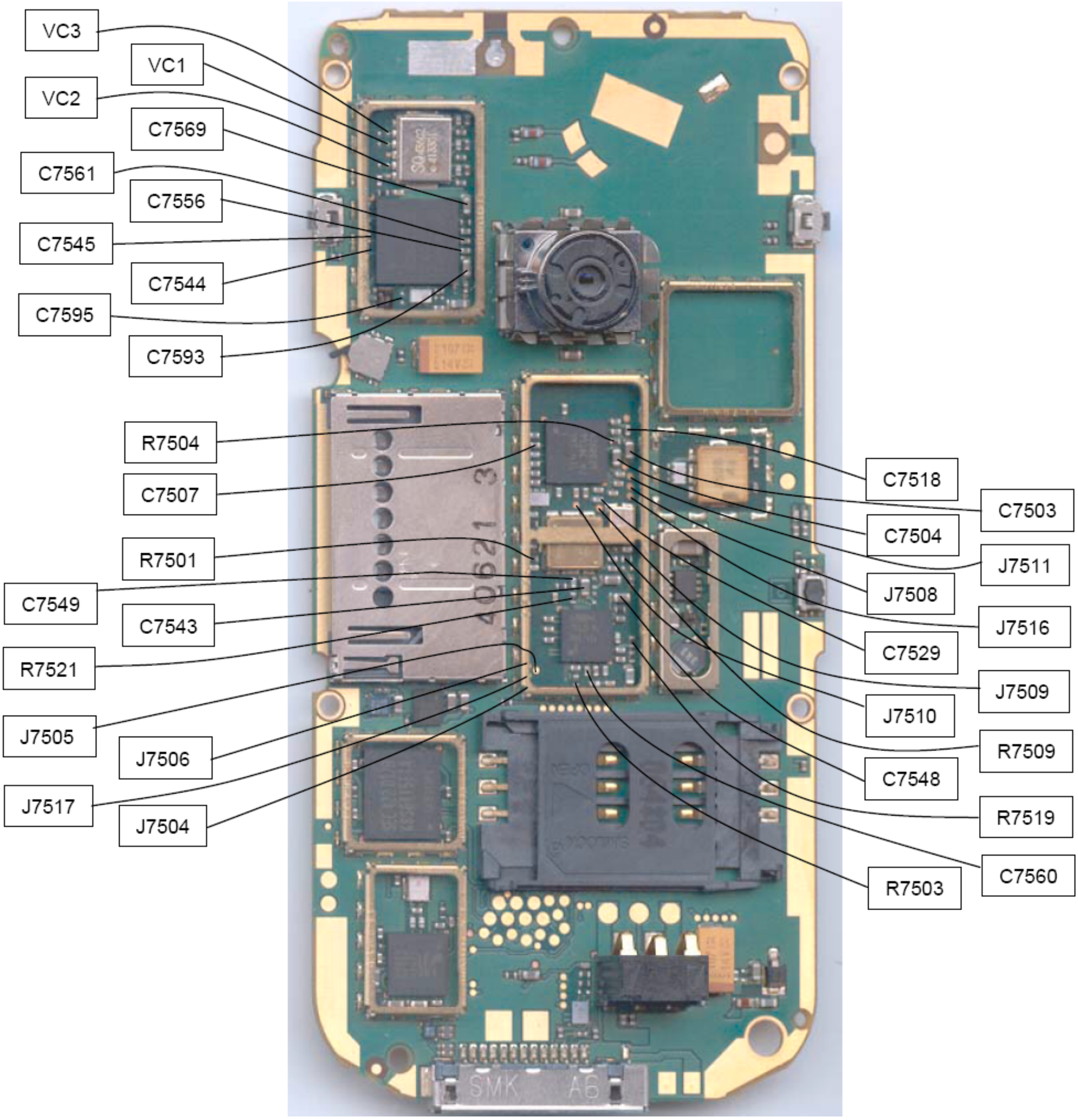

VC3
VC1
VC2
C7569
C7561
C7556
C7545
C7544
C7595
C7593
R7504
C7507
R7501
C7549
C7543
R7521
J7505
J7506
J7517
J7504
C7518
C7503
C7504
J7511
J7508
J7516
C7529
J7509
J7510
R7509
C7548
R7519
C7560
R7503

Figure 63 Test points for oscilloscope - bottom

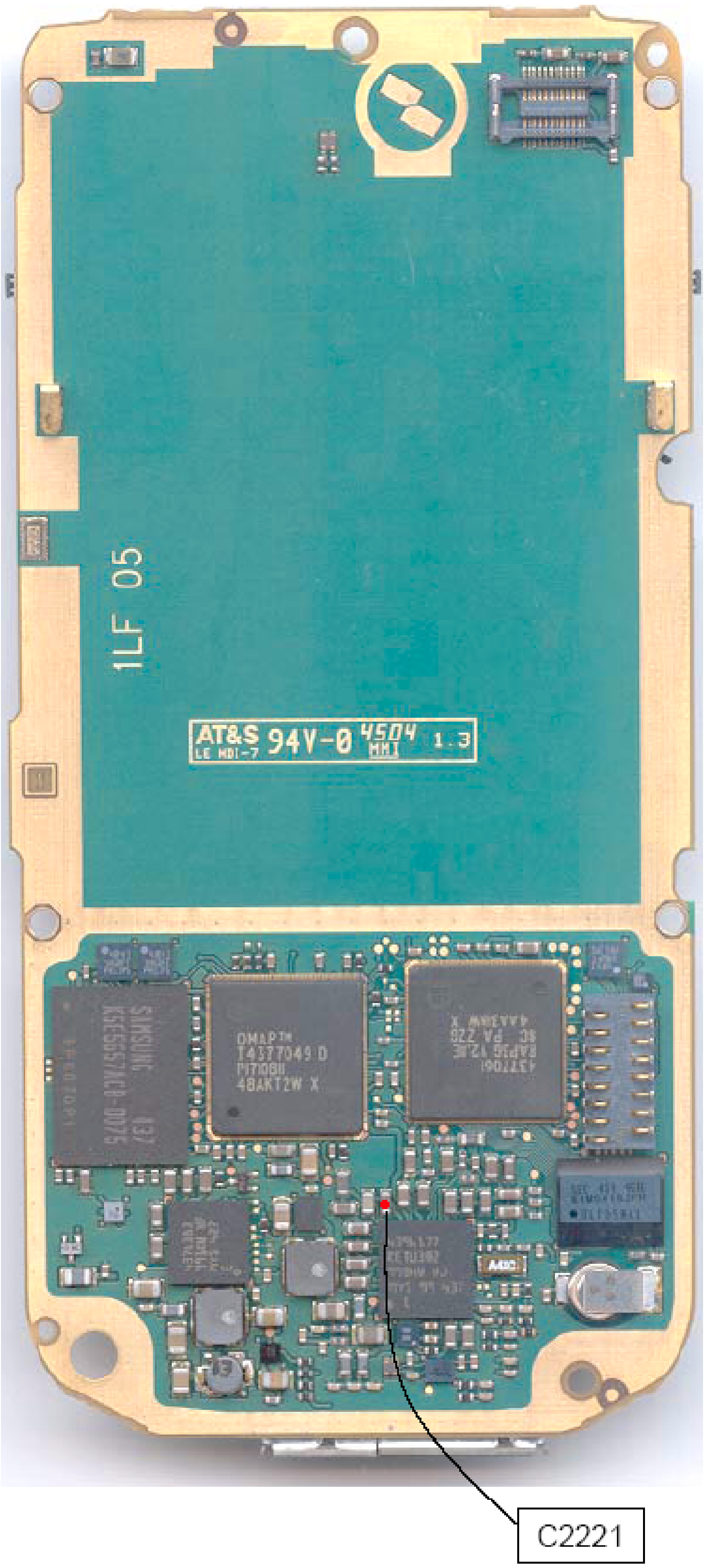


Figure 64 Test points for oscilloscope - top

Receiver troubleshooting

Introduction to Rx troubleshooting

Rx can be tested by making a phone call or in the local mode. For the local mode testing, use Phoenix service software.

The main Rx troubleshooting measurement is RSSI measurement. This test measures the signal strength of the received signal. I and Q branches can be measured separately. For GSM RSSI measurement, see GSM Rx chain activation for manual measurements / GSM RSSI measurement (Page 7–10).

In GSM, the input signal can be either a real GSM signal or a CW signal that is 67.771kHz up from the carrier frequency.

For service tool usage instructions, refer to section Service Tools and Service Concepts.

GSM Rx chain activation for manual measurements / GSM RSSI measurement

Context

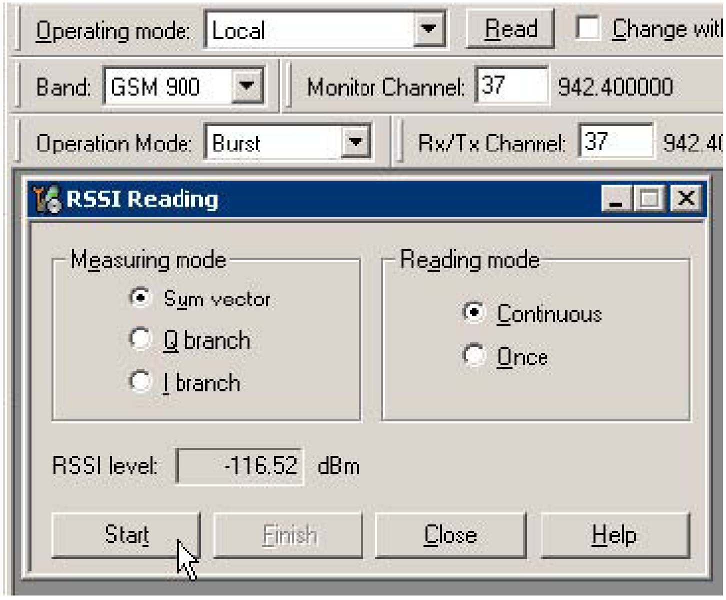
RSSI signal measurement is the main Rx troubleshooting measurement. The test measures the strength of the received signal.

I and Q branches can be measured separately. In GSM, the input signal can be either real GSM signal or CW signal that is 67.771kHz up from the carrier frequency.

Steps

1. Start *Phoenix* service software.
2. From the Testing menu, choose GSM and RSSI Reading.
3. Set the RF signal generator for channel frequency +67.771kHz CW mode with −80dBm signal.

   Alternatively set cellular tester downlink channel to the appropriate channel.
4. In the *RSSI Reading* window, select the appropriate band and channel.



Operating mode: Local

Band: GSM 900

Monitor Channel: 37 942.400000

Operation Mode: Burst

Rx/Tx Channel: 37 942.4

Measuring mode: ● Sum vector ○ Q branch ○ I branch

Reading mode: ● Continuous ○ Once

RSSI level: -116.52 dBm

Figure 65 RSSI Reading window

5. To start measurement/activate GSM Rx chain, click the Start button.

Results

RSSI reading values of the selected band and channel are displayed.

Transmitter troubleshooting

General instructions for Tx troubleshooting

Context

- Tx troubleshooting requires Tx operation.
- Do not transmit on frequencies that are in use!
- Transmitter can be controlled in the local mode for diagnostic purposes.
- The most useful Phoenix tool for GSM transmitter testing is "RF Controls".
- Tx IQ tuning and Tx power tuning can be also used in some cases.
- Remember that retuning is not a fix! Phones are tuned correctly in production.

The first set of steps instructs how to assemble the test setup. This setup is general for all Tx troubleshooting tasks.

Alternative steps provide specific troubleshooting instructions for *Phoenix* service software.

> **Caution:** Never activate the GSM transmitter without a proper antenna load. There should be always 50 ohm load connected to the RF connector (antenna, RF-measurement equipment or at least 2 watts dummy load), otherwise GSM PA may be damaged.

Steps

1. Connect a test jig to a computer with a DAU-9S cable or to a FPS-8 flash prommer with a modular cable.

   Make sure that you have a PKD-1 dongle connected to the computer's parallel port.
2. Connect a DC power supply to a module jig (MJ-26).

   > **Note:** When repairing or tuning a transmitter, use an external DC supply with at least 3 A current capability.
   >
   > Set the DC supply voltage to 3.9 V and set the jumper connector on the test jig's **reg.pass** switch to “ON” position.
3. Connect an RF cable between the RF connector of the module test jig (MJ-26) and measurement equipment or alternatively use a 50 ohms (at least 2 W) dummy load in the module test jig RF connector, otherwise the GSM PA may be damaged.

   > **Note:** There are two antenna connectors in the module jig:
   >
   > - one for GSM
   > - one for Bluetooth
   >
   > Make sure that all connections are made to the correct RF connector.

   Normally a spectrum analyser is used as measurement equipment.

   > **Note:** The maximum input power of a spectrum analyser is +30 dBm.
   >
   > To prevent any damage, it is recommended to use 10 dB attenuator on the spectrum analyzer input.
4. Set Tx on.

   i Set the phone module to the test jig and start *Phoenix service software*.

   ii Initialize connection to the phone. (With FPS-8 use FBUS driver when using DAU-9S and COMBOX driver).

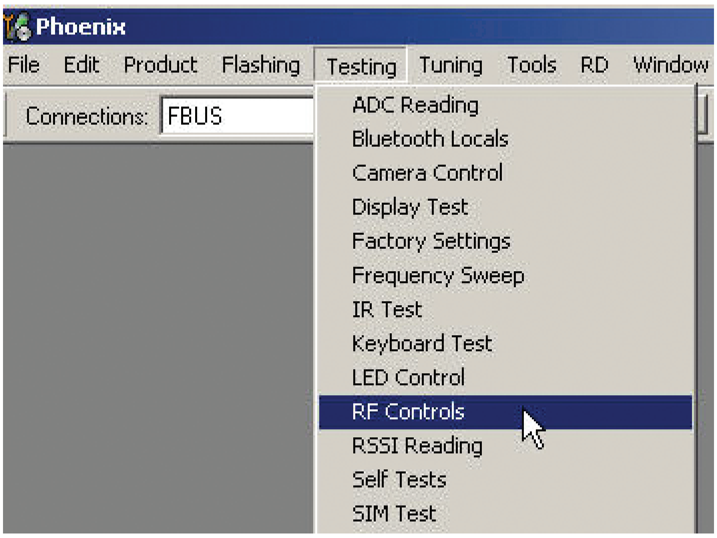
   iii From the File menu, choose product: *File -> Choose Product -> xx-x** (* = type designator of the phone).

   iv From the toolbar, set operating mode to “Local”.

Alternative steps

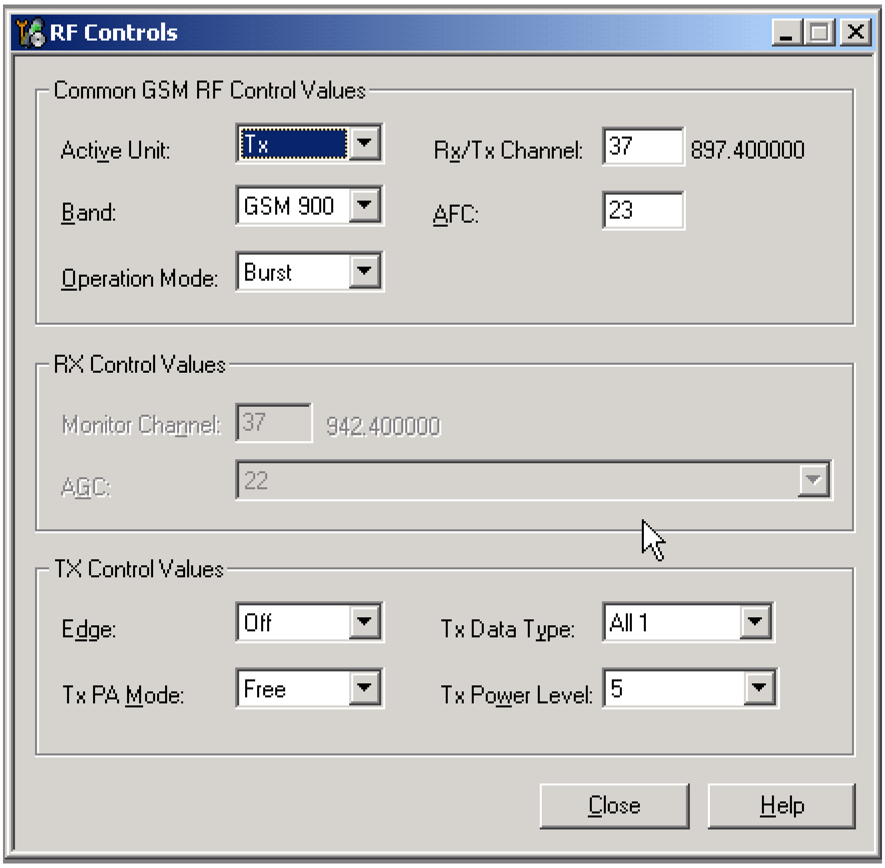
- GSM850, EGSM900/GSM1800/GSM1900 troubleshooting

  i From the Testing menu, activate the *RF Controls* window: *Testing -> RF Controls* .


Phoenix
File
Edit
Product
Flashing
Testing
Tuning
Tools
RD
Window
Connections:
FBUS
ADC Reading
Bluetooth Locals
Camera Control
Display Test
Factory Settings
Frequency Sweep
IR Test
Keyboard Test
LED Control
RF Controls
RSSI Reading
Self Tests
SIM Test

  ii In the *RF Controls* window:

  - Select band “GSM900” ("GSM850" for RM-58) or “GSM1800” or “GSM1900” (Default = “GSM900”).
  - Set Active unit to “Tx” (Default = “Rx”).
  - Set Operation mode to “Burst” (Default = “Burst”).
  - Set Tx data type to “All1” (Default = “All1”).
  - Set Rx/Tx channel to "190" on GSM850 band, "37" on GSM900 band or "700" on GSM1800 band or "661" on GSM1900 (Defaults).
  - Set Edge to “Off” (Default).
  - Set Tx PA mode to “Free” (Default).
  - Set power level to 5 (Default = 19) on GSM850/GSM900 or to 0 (Default = 15) on GSM1800/GSM1900.



RF Controls

Common GSM RF Control Values
Active Unit: Tx
Rx/Tx Channel: 37 897.400000
Band: GSM 900
AFC: 23
Operation Mode: Burst

RX Control Values
Monitor Channel: 37 942.400000
AGC: 22

TX Control Values
Edge: Off
Tx Data Type: All 1
Tx PA Mode: Free
Tx Power Level: 5

Figure 66 RF Controls window

Checking GSM and Bluetooth antenna functionality

The GSM antenna has one Feed and two GND contacts.

The contacts of the GSM antenna are separated in the (RDC = 0 ohm) short-circuit.

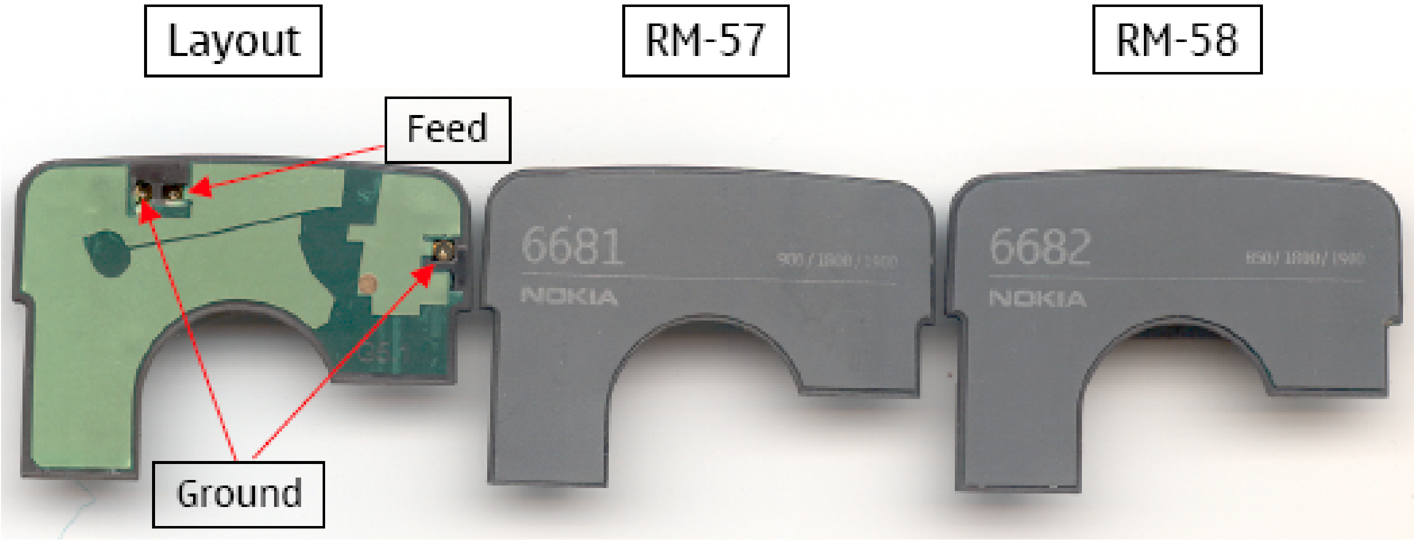

Layout
RM-57
RM-58
Feed
Ground
6681
900 / 1800 / 1900
NOKIA
6682
850 / 1800 / 1900
NOKIA

Figure 67 Feed and GND spots of the main antenna

The antenna is functioning normally when the contacts function (RDC = 0 ohm) and the antenna is visually intact.

BT antenna

BT antenna has one Feed and two GND contacts. The antenna is functioning normally when the contacts function (RDC = 0 ohm) and the antenna is visually intact.

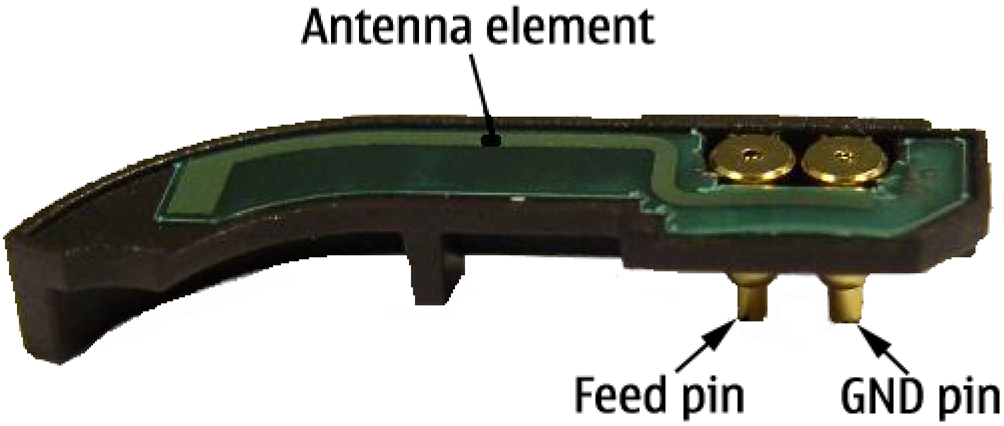


Figure 68 BT antenna

RF tuning

Introduction to RF tunings

Phone RF is tuned in production. There is no reason to do the re-calibration unless:

- One or more of the RF components is changed
- FLASH Memory chip (D3000) is changed or otherwise corrupted.

Note: RF calibration is always performed with the help of a product-specific module jig, never with an RF coupler. Using an RF coupler in the calibration phase will cause a complete mistuning of the RF side.

Important: After RF component changes, autotuning is recommended. RF autotuning covers all necessary tunings which are required after RF component repairs.

Cable and adapter losses

RF cables and adapters have some losses. They have to be taken in account when the phone is tuned. As all the RF losses are frequency dependent, the user have to be very careful and understand the measurement setup. In the following table there are RF attenuations of the module jig:

Band	Attenuation
GSM850/GSM900	0.2 dB
GSM1800	0.3 dB
GSM1900	0.3 dB

RF autotuning

Before you begin

For information on the recommended test set-up, refer to the corresponding information on PWS/NOL.

Before you can use the auto-tune feature, the GPIB driver from the GPIB card vendor must be installed and running.

The autotune **.ini** file must be in a correct place: **C:\Program Files\Nokia\Phoenix\products\xx-x*\autotune_xx-x*.ini** (**= indicates the type designator of the phone, e.g. RM-1*)

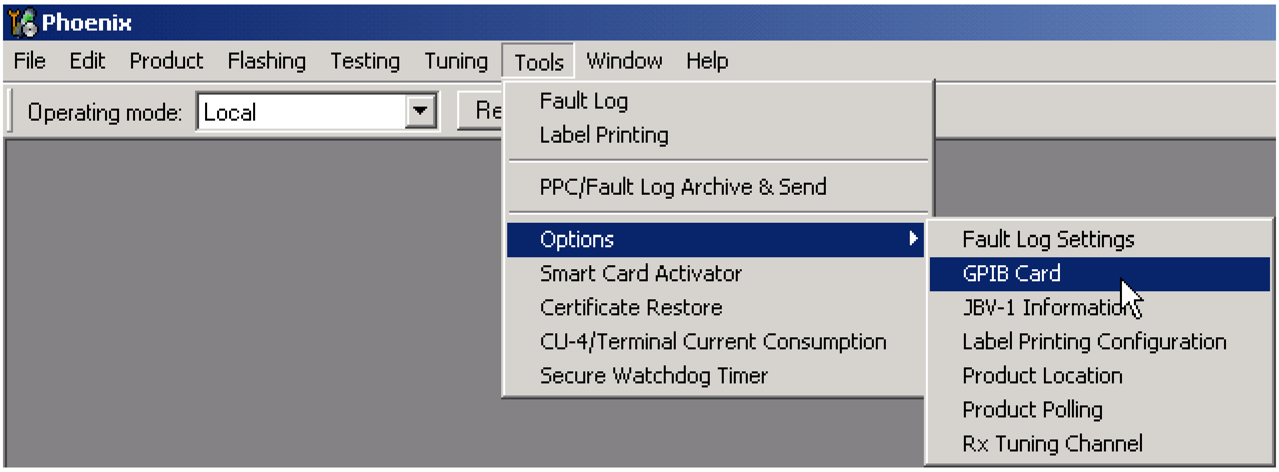
Context

RF autotuning is performed with the aid of Digital Radio Communication Tester. Autotuning covers all RF tunings that are needed to perform after RF component repairs.

> **Note:** Do not perform RF autotuning without a proper reason. Phones are tuned in production and RF tuning may performed only after component repairs or if the RF tuning information is lost.

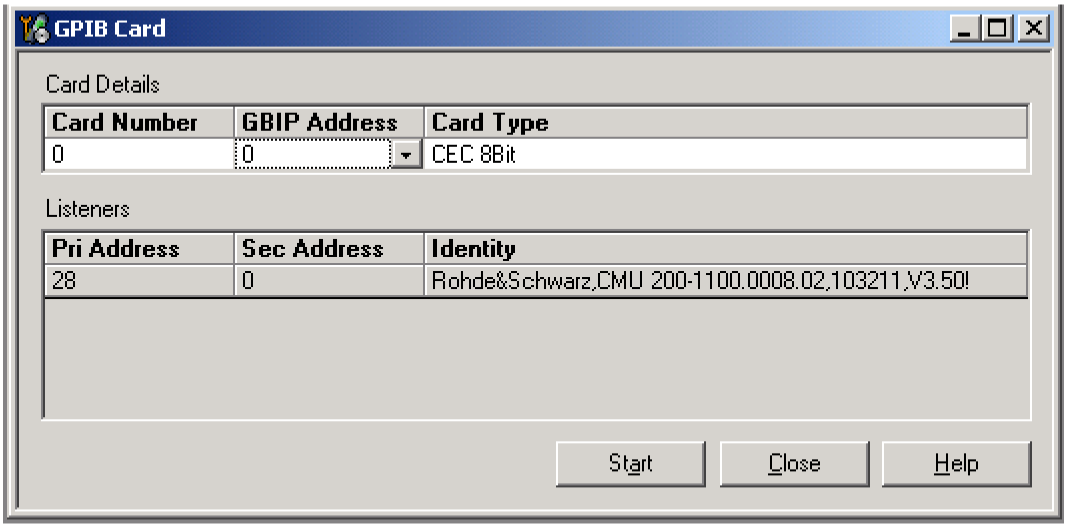
Steps

1. Connect the communication tester to the GPIB bus.
2. Start Phoenix service software.
3. From the Tools menu in Phoenix, choose Options -> GPIB Card.


Phoenix
File
Edit
Product
Flashing
Testing
Tuning
Tools
Window
Help
Operating mode:
Local
Re
Fault Log
Label Printing
PPC/Fault Log Archive & Send
Options
Smart Card Activator
Certificate Restore
CU-4/Terminal Current Consumption
Secure Watchdog Timer
Fault Log Settings
GPIB Card
JBV-1 Information
Label Printing Configuration
Product Location
Product Polling
Rx Tuning Channel

4. In the Card Type line, select CEC8Bit, then click Start.

   After clicking Start, the name of the communication tester appears in the list of found Listeners.


GPIB Card
Start
Close
Help

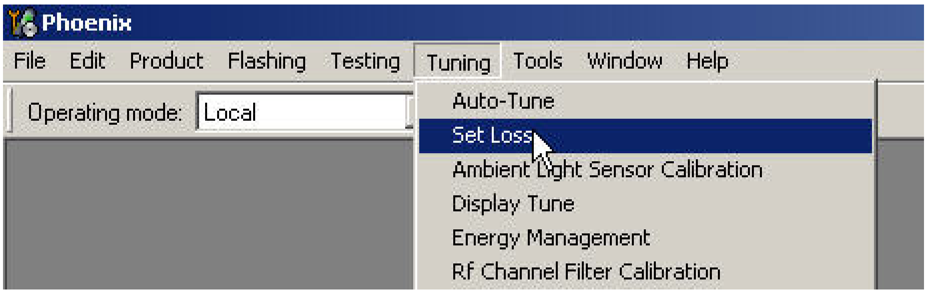
Card Details

Card Number	GBIP Address	Card Type
0	0	CEC 8Bit

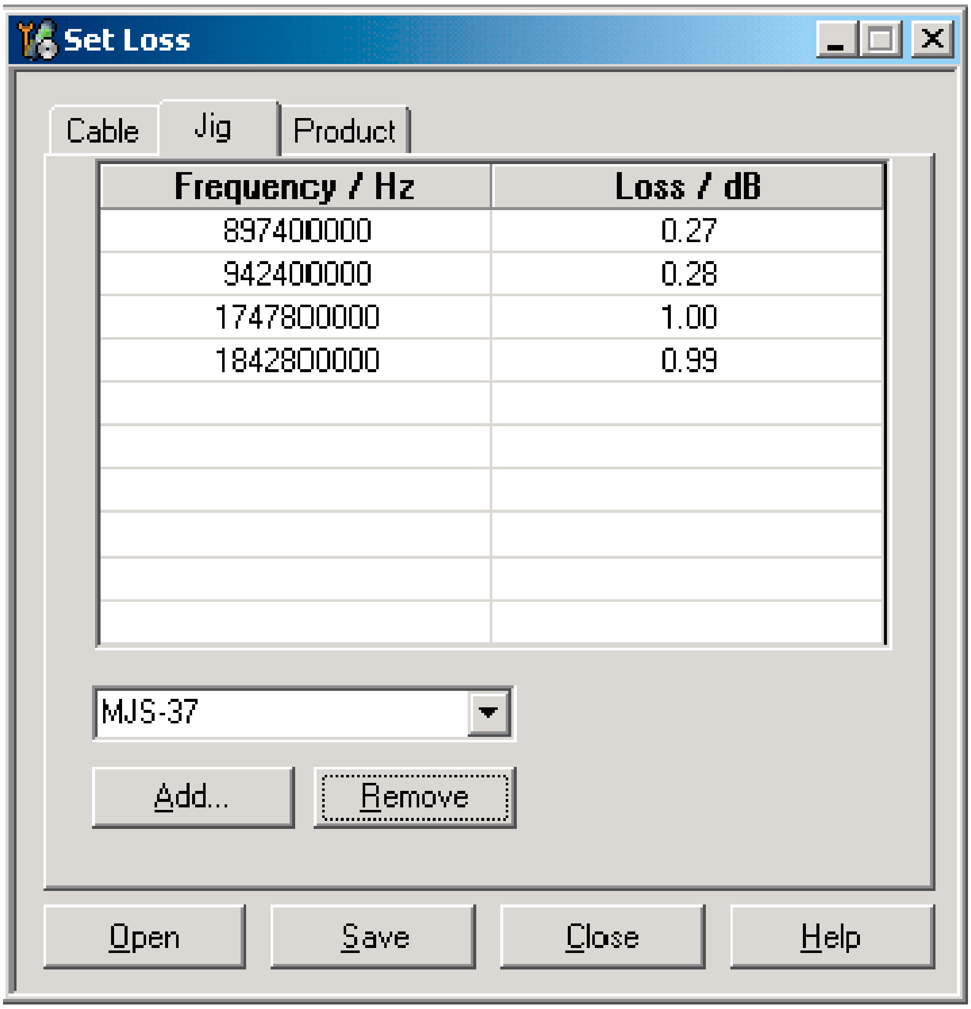
Listeners

Pri Address	Sec Address	Identity
28	0	Rohde&Schwarz,CMU 200-1100.0008.02,103211,V3.50!

5. To specify the cable loss from module jig to the communication tester, choose Set Loss from the Tuning menu.


Phoenix
File
Edit
Product
Flashing
Testing
Tuning
Tools
Window
Help
Operating mode:
Local
Auto-Tune
Set Loss
Ambient Light Sensor Calibration
Display Tune
Energy Management
RF Channel Filter Calibration

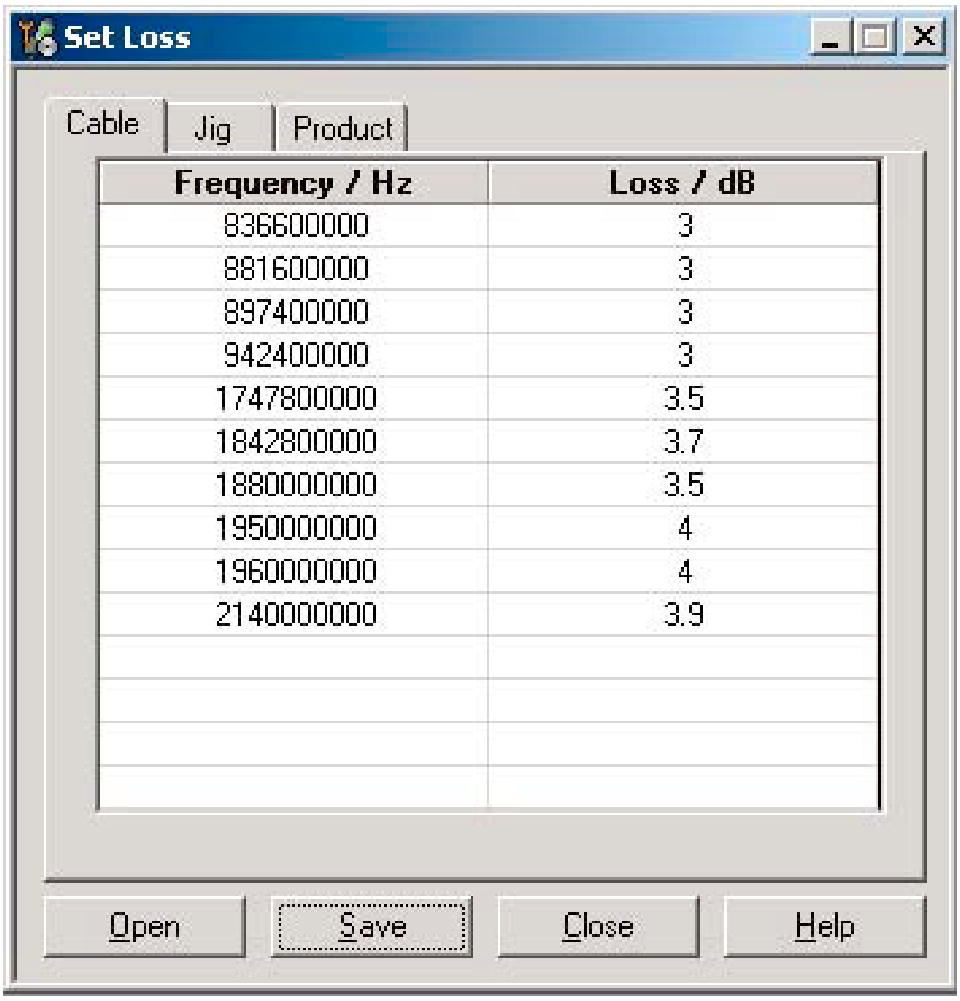
6. In the Set Loss window, click the Jig tab and select the right jig for the phone.


Set Loss
Cable
Jig
Product
Add...
Remove
Open
Save
Close
Help

Frequency / Hz	Loss / dB
897400000	0.27
942400000	0.28
1747800000	1.00
1842800000	0.99

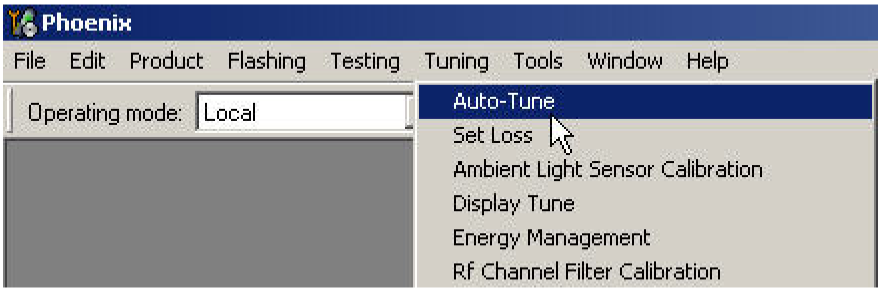
MJS-37

7. Click the Cable tab and add the extra cable attenuation.


Set Loss
Cable
Jig
Product
Open
Save
Close
Help

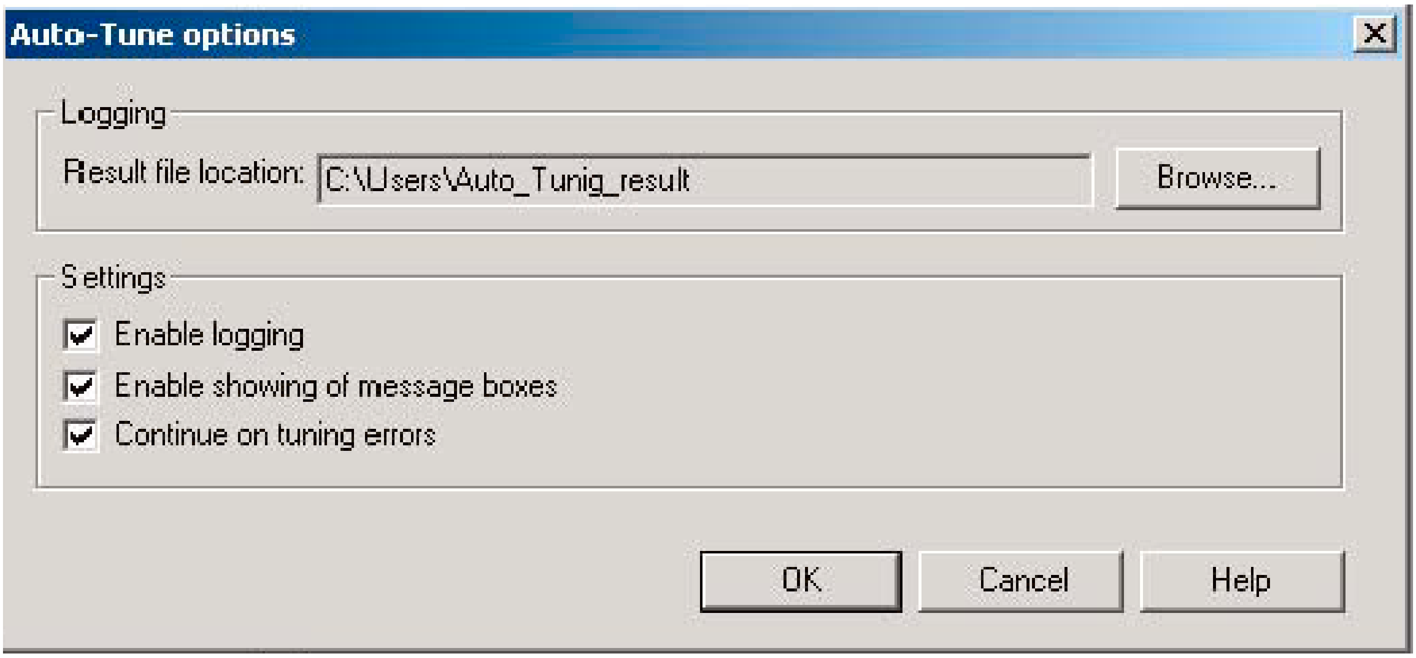
Frequency / Hz	Loss / dB
836600000	3
881600000	3
897400000	3
942400000	3
1747800000	3.5
1842800000	3.7
1880000000	3.5
1950000000	4
1960000000	4
2140000000	3.9

8. To start autotuning, choose Auto-Tune from the Tuning menu.


Phoenix
File
Edit
Product
Flashing
Testing
Tuning
Tools
Window
Help
Operating mode:
Local
Auto-Tune
Set Loss
Ambient Light Sensor Calibration
Display Tune
Energy Management
Rf Channel Filter Calibration

9. In the Auto-Tune window, click Options.

10. In the Auto-Tune options window, see that the "Enable showing of messages" check box is checked, and click OK.



Auto-Tune options

Logging

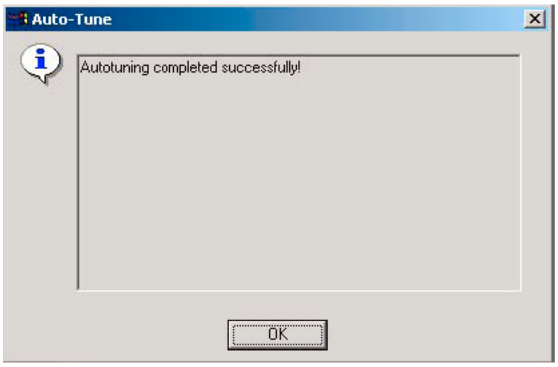
Result file location: C:\Users\Auto_Tunig_result

Settings

☑ Enable logging
☑ Enable showing of message boxes
☑ Continue on tuning errors

Results

"Autotuning completed successfully" message appears.



Auto-Tune

Autotuning completed successfully!

RF manual tuning guide

Required manual tunings after component changes

Important: After RF component changes, autotuning is recommended. RF autotuning covers all necessary tunings which are required after RF component repairs.

If, however, manual tuning is used, only relevant tunings should be performed. Refer to the following table:

Changed component	Perform following tunings
Tx RF ASIC Vinku (N7501)	RF Channel Filter Calibration, Tx IQ Tuning, Tx Power Level Tuning, Temperature Sensor Calibration
RX RF ASIC Hinku (N7500)	RF Channel Filter Calibration, Rx Calibration, Rx Band Filter Response Compensation, Rx AM Suppression

Changed component	Perform following tunings
Any component in the GSM TX RF chain before the PA	Tx IQ Tuning, Tx Power Level Tuning
Any component in the GSM TX RF chain after the PA or PA	Tx Power Level Tuning
Any component in the GSM RX chain	Rx Calibration, RX Band Filter Response Compensation, RX AM Suppression
VCTCXO (G7501)	Rx Calibration (GSM850 band)

RF channel filter calibration

Context

Rx channel filter calibration tunes Rx and Tx ASICs' internal low pass filters that limit the bandwidth of BB IQ signals.

Table 13 RF channel filter calibration tuning limits

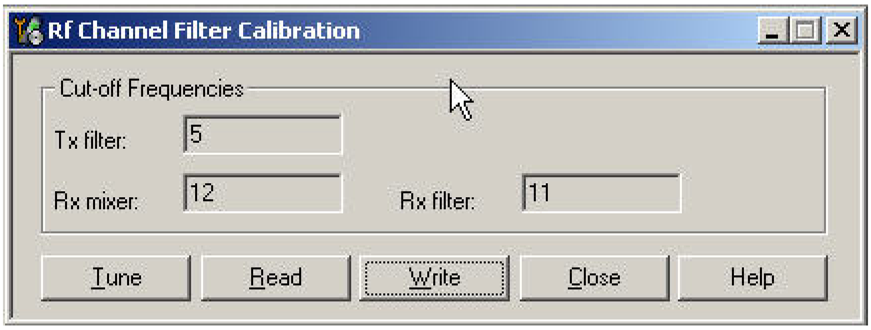
	Min	Typ	Max
Tx filter	0	5	31
Rx filter	0	11	31

Steps

1. From the dropdown menus, set "System mode" to "Local".
2. From the Tuning menu, choose *RF Channel Filter Calibration*.
3. Click Tune.
4. Click Write.

   Saves tuned values to the PMM area.
5. To close the tuning window, click Close.

Results



Rf Channel Filter Calibration

Cut-off Frequencies

Tx filter: 5

Rx mixer: 12

Rx filter: 11

Figure 69 RF channel filter calibration typical values

Temperature sensor calibration

Context

There is a temperature sensor integrated into VINKU ASIC. VINKU provides DC-voltage, which is temperature dependent.

Temperature sensor calibration is done in room temperature, in which offset caused by VINKU variation and AD-converter inside RETU are nullified.

The module is able to do this calibration by itself, no external equipment is needed.

The temperature of the module and components must be 23 +/-2 degrees.

Steps

1. From the dropdown menus, set "Operating mode" to "Local".
2. From the Tuning menu, choose "Temperature Sensor Calibration".
3. Click Tune.

Table 14 Temperature sensor calibration tuning limits

Min	Typ	Max	Unit
-20	-4	20	^{0}C

4. A pop-up window appears asking: “Save Values to PM?”; click “Yes”
5. To finish the calibration, click "Close".

Receiver tunings

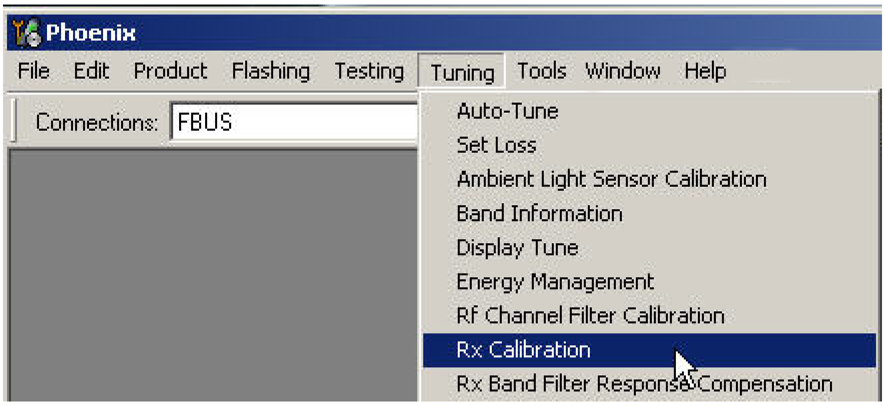
Rx calibration

Context

Rx Calibration is used to find out the real gain values of the GSM Rx AGC system and tuning response of the AFC system (AFC D/A init value and AFC slope)

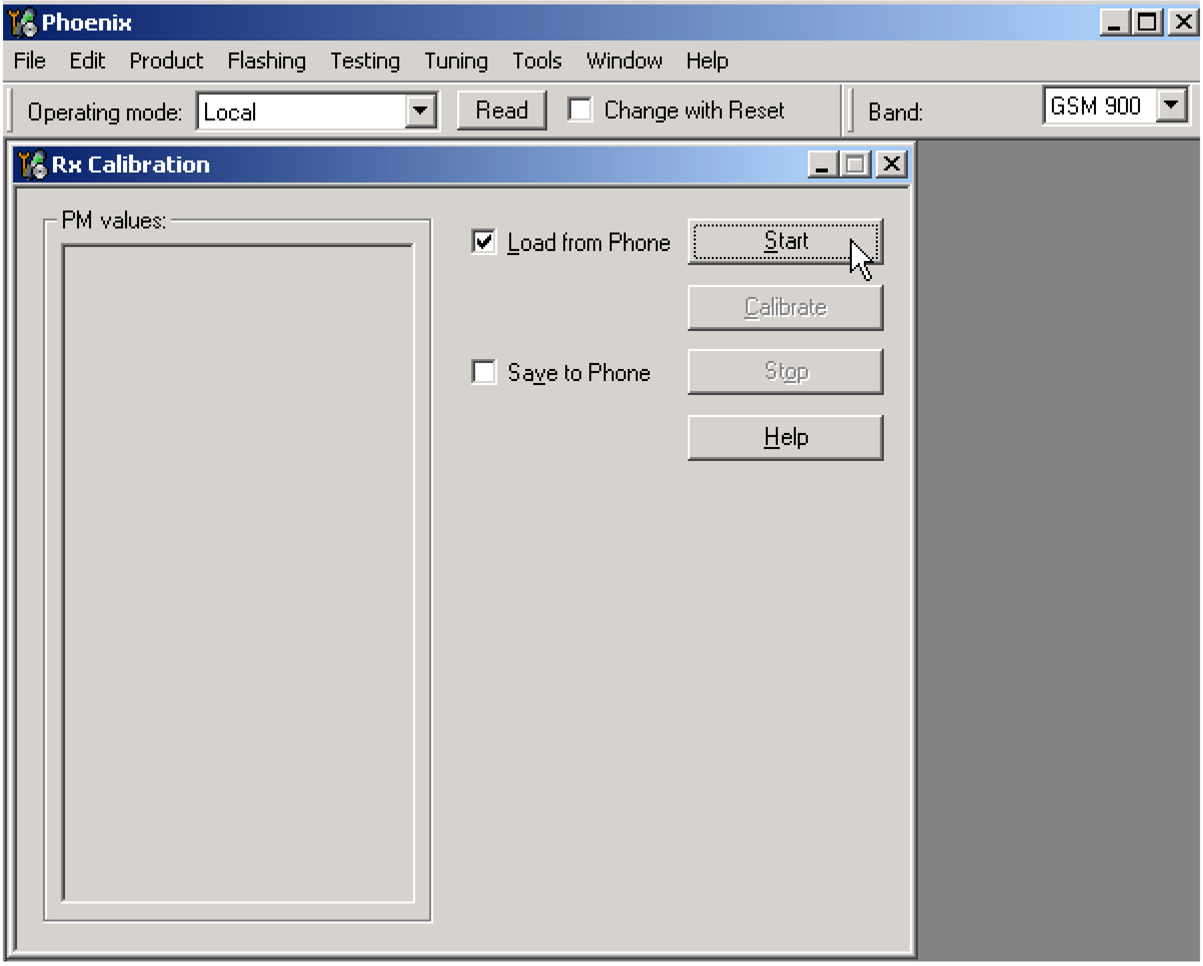
Steps

1. Connect the module jig’s GSM connector to the signal generator.
2. From the "Operating mode" dropdown menu, set mode to "Local".
3. From the Tuning menu, choose "Rx Calibration".

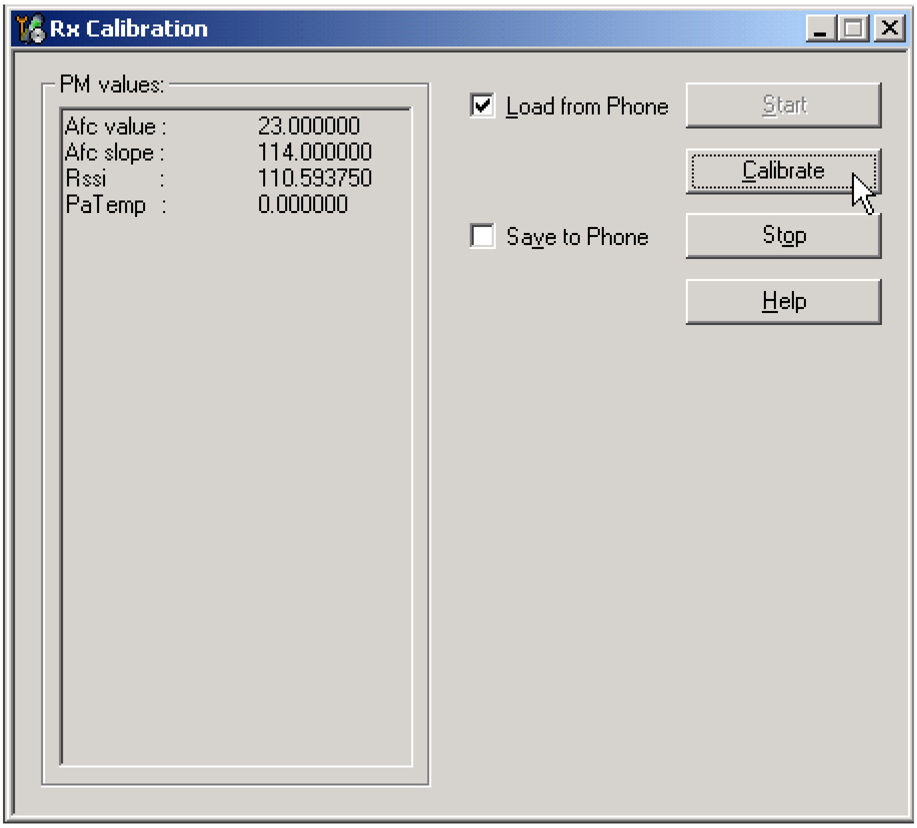

Phoenix
File Edit Product Flashing Testing Tuning Tools Window Help
Connections: FBUS
Auto-Tune
Set Loss
Ambient Light Sensor Calibration
Band Information
Display Tune
Energy Management
RF Channel Filter Calibration
Rx Calibration
Rx Band Filter Response Compensation

4. Check the “Load from Phone” check box and clear the “Save to Phone” checkbox.
5. From the Band dropdown menu, choose GSM900/GSM850.

6. Click Start (if it not active already).


Phoenix
File Edit Product Flashing Testing Tuning Tools Window Help
Operating mode: Local
Read
☐ Change with Reset
Band: GSM 900
Rx Calibration
PM values:
☑ Load from Phone
Start
Calibrate
☐ Save to Phone
Stop
Help

7. Click Calibrate.



PM values:

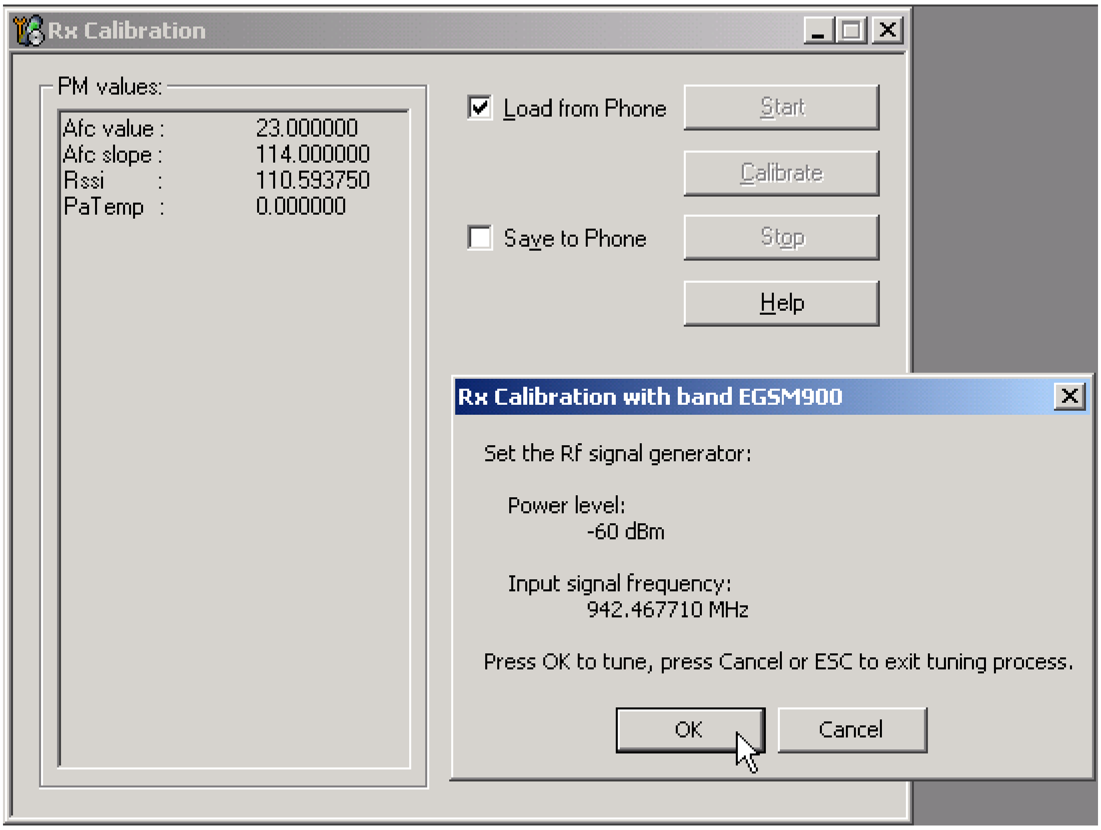
Afc value : 23.000000
Afc slope : 114.000000
Rssi : 110.593750
PaTemp : 0.000000

☑ Load from Phone

☐ Save to Phone

8. Connect the signal generator to the phone.
9. Set frequency and amplitude as instructed in the "Rx Calibration with band GSM850/EGSM900" popup window.

   The calibration uses a non-modulated CW signal. Increase the signal generator level by cable attenuation and module jig probe attenuation!


Rx Calibration
Start
Calibrate
Stop
Help
Rx Calibration with band EGSM900
OK
Cancel

PM values:

Afc value : 23.000000
Afc slope : 114.000000
Rssi : 110.593750
PaTemp : 0.000000

☑ Load from Phone

☐ Save to Phone

Set the Rf signal generator:

Power level:
-60 dBm

Input signal frequency:
942.467710 MHz

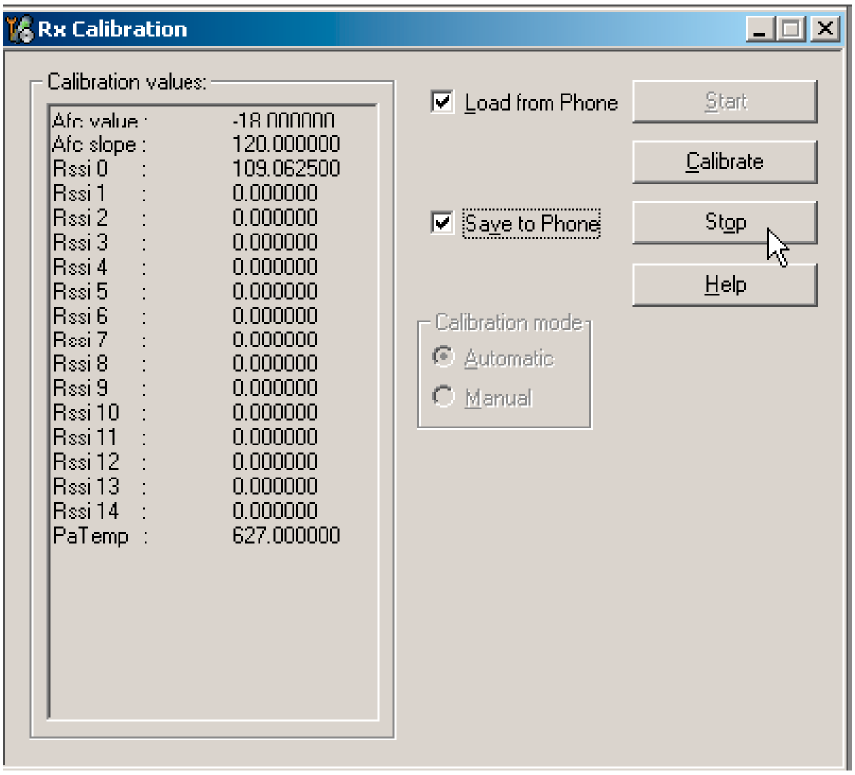
Press OK to tune, press Cancel or ESC to exit tuning process.

10. To perform tuning, click OK.
11. Check that the tuning values are within the limits specified in this table:

Table 15 RF tuning limits in Rx calibration

	Min	Typ	Max	Unit
GSM850/GSM900				
AFC Value	-200	-105 62	200	
AFC slope	0	122	200	
RSSI0	106	107 110	114	dB
GSM1800				
RSSI0	104	104 109	114	dB
GSM1900				
RSSI0	104	104 109	114	dB

12. To save values to the phone, check the "Save to Phone" check box and click Stop.



Calibration values:

Afc value	:	-18.000000
Afc slope	:	120.000000
Rssi 0	:	109.062500
Rssi 1	:	0.000000
Rssi 2	:	0.000000
Rssi 3	:	0.000000
Rssi 4	:	0.000000
Rssi 5	:	0.000000
Rssi 6	:	0.000000
Rssi 7	:	0.000000
Rssi 8	:	0.000000
Rssi 9	:	0.000000
Rssi 10	:	0.000000
Rssi 11	:	0.000000
Rssi 12	:	0.000000
Rssi 13	:	0.000000
Rssi 14	:	0.000000
PaTemp	:	627.000000

☑ Load from Phone

☑ Save to Phone

Calibration mode
● Automatic
○ Manual

Next action

Repeat steps 3 to 8 for GSM1800 and GSM1900

Rx band filter response compensation

Before you begin

Rx calibration must be performed before the Rx Band Filter Response Compensation

Context

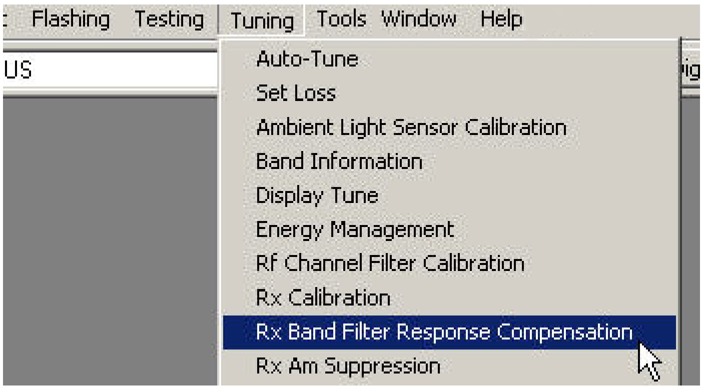
In each GSM Rx band, there's a band rejecting filter in front of the HINKU front end. The amplitude ripple caused by these filters causes ripple to the RSSI measurement and therefore calibration is needed.

The calibration has to be repeated for each GSM band.

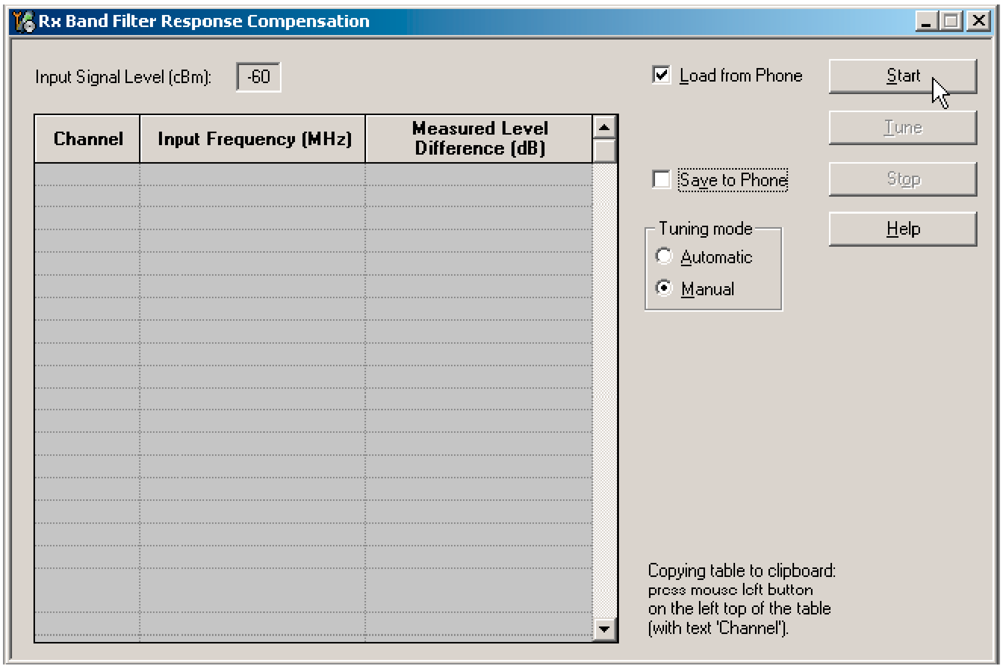
Steps

1. Connect the module jig's GSM connector to the signal generator.
2. From the dropdown menus, set "Operating mode" to "Local" and Band to "GSM900".

3. From the Tuning menu, choose "Rx Band Filter Response Compensation".


Flashing
Testing
Tuning
Tools
Window
Help
US
Auto-Tune
Set Loss
Ambient Light Sensor Calibration
Band Information
Display Tune
Energy Management
Rf Channel Filter Calibration
Rx Calibration
Rx Band Filter Response Compensation
Rx Am Suppression

4. Check “Manual” and “Load from Phone” check boxes, and clear the “Save to Phone” check box
5. Click Start.


Rx Band Filter Response Compensation
Start
Tune
Stop
Help
Tuning mode

Input Signal Level (cBm): -60

☑ Load from Phone

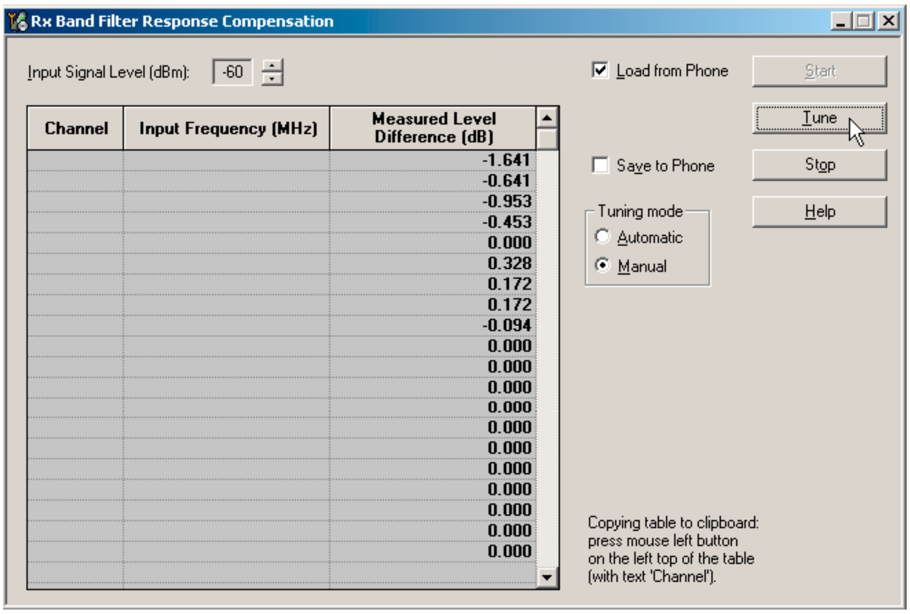
☐ Save to Phone

○ Automatic
● Manual

Channel	Input Frequency (MHz)	Measured Level Difference (dB)

Copying table to clipboard: press mouse left button on the left top of the table (with text 'Channel').

6. Click Tune.



Input Signal Level (dBm): -60

☑ Load from Phone

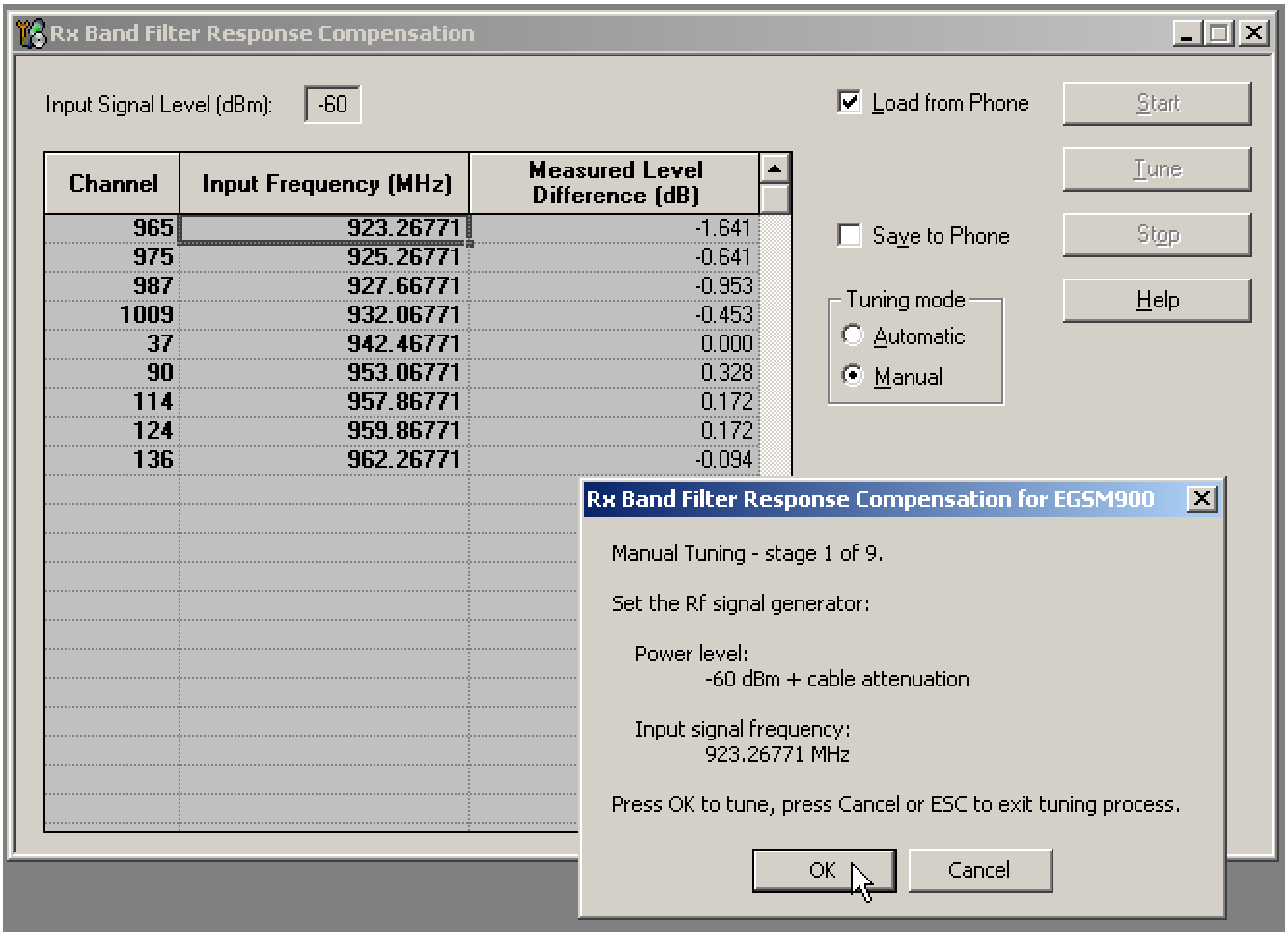
☐ Save to Phone

Tuning mode
○ Automatic
● Manual

Channel	Input Frequency (MHz)	Measured Level Difference (dB)
		-1.641
		-0.641
		-0.953
		-0.453
		0.000
		0.328
		0.172
		0.172
		-0.094
		0.000
		0.000
		0.000
		0.000
		0.000
		0.000
		0.000
		0.000
		0.000
		0.000
		0.000

Copying table to clipboard:
press mouse left button
on the left top of the table
(with text 'Channel').

7. Connect signal generator to the phone and set frequency and amplitude as instructed in the "Rx Band Filter Response Compensation for GSM850/EGSM900" popup window.



Input Signal Level (dBm): -60

☑ Load from Phone

☐ Save to Phone

Tuning mode
○ Automatic
● Manual

Channel	Input Frequency (MHz)	Measured Level Difference (dB)
965	923.26771	-1.641
975	925.26771	-0.641
987	927.66771	-0.953
1009	932.06771	-0.453
37	942.46771	0.000
90	953.06771	0.328
114	957.86771	0.172
124	959.86771	0.172
136	962.26771	-0.094

Rx Band Filter Response Compensation for EGSM900

Manual Tuning - stage 1 of 9.

Set the Rf signal generator:

Power level:
-60 dBm + cable attenuation

Input signal frequency:
923.26771 MHz

Press OK to tune, press Cancel or ESC to exit tuning process.

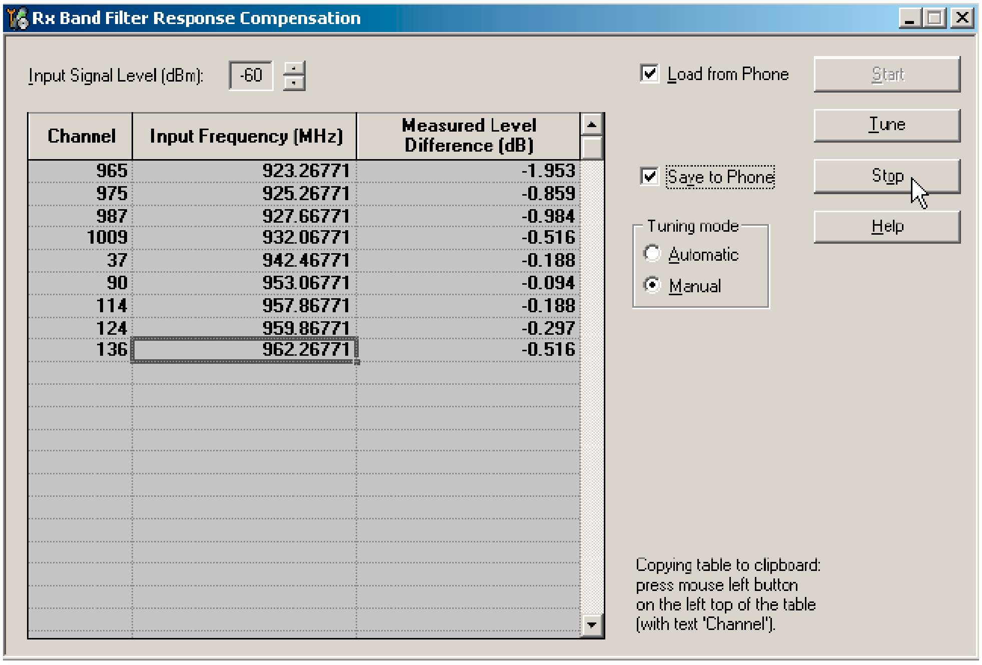
8. To perform tuning, click OK.

9. Go through all 9 frequencies.
10. Check that the tuning values are within the limits specified in this table:

	Min	Typ	Max	Unit
GSM850/GSM900				
Ch. 965 / 923.26771 MHz	-10	-1	5	dB
Ch. 975 / 925.26771 MHz	-3	0	5	dB
Ch. 987 / 927.66771 MHz	-3	0	5	dB
Ch. 1009 / 932.06771 MHz	-3	0	5	dB
Ch. 37 / 942.46771 MHz	-3	0	5	dB
Ch. 90 / 953.06771 MHz	-3	0	5	dB
Ch. 114 / 957.86771 MHz	-3	0	5	dB
Ch. 124 / 959.86771 MHz	-3	0	5	dB
Ch. 136 / 962.26771 MHz	-10	-1	5	dB
GSM1800				
Ch. 497 / 1802.26771 MHz	-10	-1	5	dB
Ch. 512 / 1805.26771 MHz	-3	0	5	dB
Ch. 535 / 1809.86771 MHz	-3	0	5	dB
Ch. 606 / 1824.06771 MHz	-3	0	5	dB
Ch. 700 / 1842.86771 MHz	-3	0	5	dB
Ch. 791 / 1861.06771 MHz	-3	0	5	dB
Ch. 870 / 1876.86771 MHz	-3	0	5	dB
Ch. 885 / 1879.86771 MHz	-3	0	5	dB
Ch. 908 / 1884.46771 MHz	-10	-1	5	dB

	Min	Typ	Max	Unit
GSM1900				
Ch. 496 / 1927.06771 MHz	-10	-1	5	dB
Ch. 512 / 1930.26771 MHz	-3	0	5	dB
Ch. 537 / 1935.26771 MHz	-3	0	5	dB
Ch. 586 / 1945.06771 MHz	-3	0	5	dB
Ch. 661 / 1960.06771 MHz	-3	0	5	dB
Ch. 736 / 1975.06771 MHz	-3	0	5	dB
Ch. 794 / 1986.66771 MHz	-3	0	5	dB
Ch. 810 / 1989.86771 MHz	-3	0	5	dB
Ch. 835 / 1994.86771 MHz	-10	-1	5	dB

11. If the values are within the limits, check the "Save to Phone" check box and click Stop.



Input Signal Level (dBm): -60

☑ Load from Phone

☑ Save to Phone

Tuning mode
○ Automatic
● Manual

Channel	Input Frequency (MHz)	Measured Level Difference (dB)
965	923.26771	-1.953
975	925.26771	-0.859
987	927.66771	-0.984
1009	932.06771	-0.516
37	942.46771	-0.188
90	953.06771	-0.094
114	957.86771	-0.188
124	959.86771	-0.297
136	962.26771	-0.516

Copying table to clipboard:
press mouse left button
on the left top of the table
(with text 'Channel').

Next action

Repeat the steps 4 to 10 for GSM1800 and GSM1900.

Rx AM suppression

Context

Rx AM suppression is used to tune the AM suppression capabilities of the GSM receiver.

AM suppression is related to ability of the receiver to operate when there is disturbing AM modulated signal near the received channel signal frequency.

RFIC has tunable compensation circuit which has an effect on the AM suppression ability.

In the tuning, a continuous useful signal added with an AM modulated signal 10MHz above current channel is fed to the antenna. RFIC control word values are iterated until a minimum RSSI signal is found.

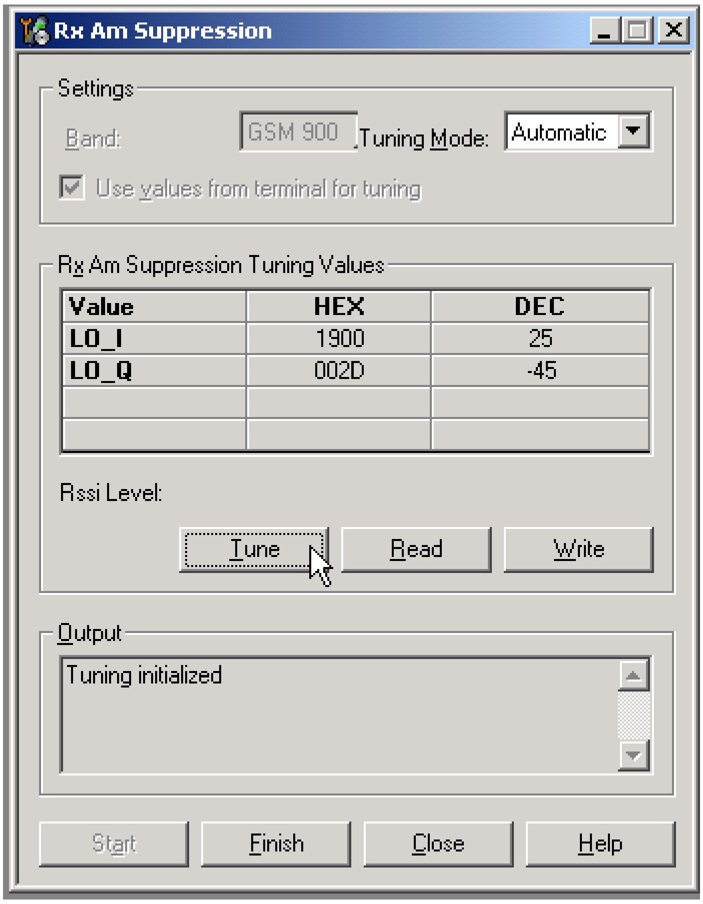
Steps

1. Connect the module jig's GSM connector to the signal generator.
2. From the dropdown menus, set "Operating mode" to "Local" and Band to "GSM900".
3. From the Tuning menu, choose "Rx AM Suppression".
4. Check the "Automatic" check box.
5. Connect the signal generator to the phone according to the frequency and modulation parameters displayed in the tuning window:

Frequency	**891.667710MHz**MHz / **952.46771**MHz / **1852.86771**MHz / **1970.06771**MHz (depending on the band used)
Power level	**-31** dBm / **-26** dBm / **-29** dBm (increase by cable and jig attenuations)
Modulation	AM
AM modulation depth	90%
Modulation signal	50 kHz sinewave (or 15 kHz if 50 kHz is not available)

6. Click Start.

7. Click Tune.


Rx Am Suppression
Settings
Rx Am Suppression Tuning Values
Tune
Read
Write
Output
Start
Finish
Close
Help

Band: GSM 900
Tuning Mode: Automatic
☑ Use values from terminal for tuning

Value	HEX	DEC
LO_I	1900	25
LO_Q	002D	-45

Rssi Level:

Tuning initialized

8. Check that the RSSI level value is between the limits presented in this table. If this is not the case, try clicking the Tune button again.

Table 16 RSSI level values

Band	Min	Max	Unit
GSM850/GSM900	-115	-90	dB
GSM1800	-115	-85	dB
GSM1900	-115	-100	dB

9. Make sure that the "Save to Phone" check box is checked and click Stop.

Next action

Repeat steps 3 to 7 for GSM1800 and GSM1900.

Transmitter tunings

Tx IQ tuning

Context

The Tx path branches to I and Q signals at the RF I/Q modulator. Modulator and analog hardware located after the modulator cause unequal amplitude and phase disturbance to I and Q signal paths. Tx IQ tuning balances the I and Q branches.

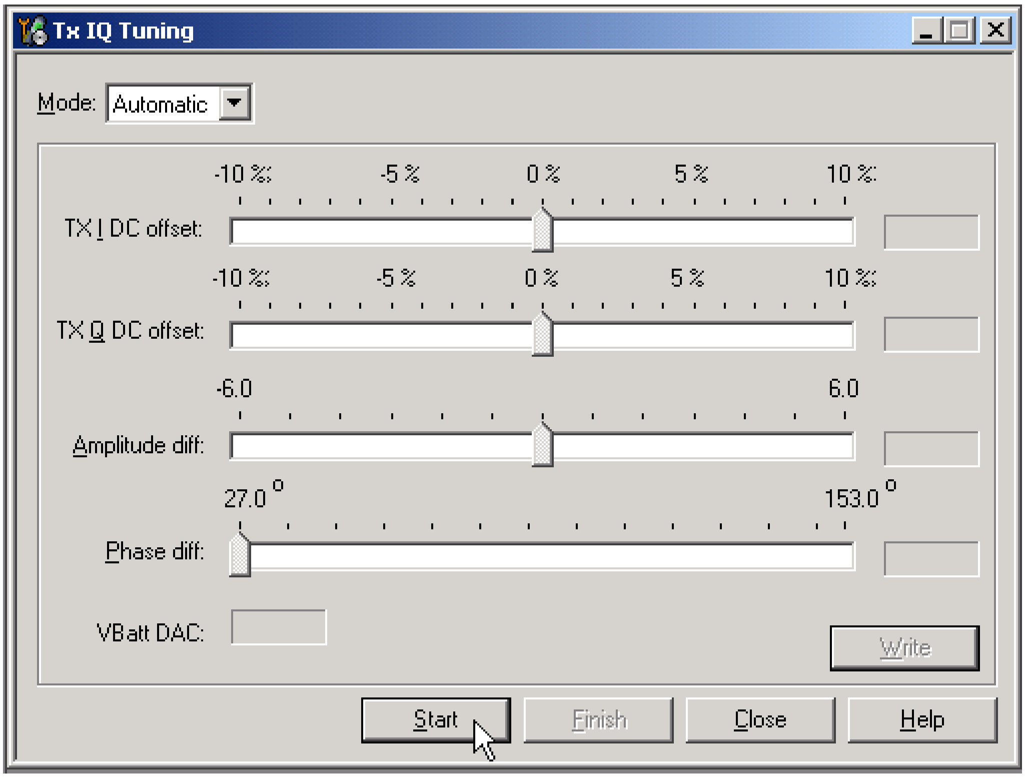
Tx IQ tuning must be performed on all GSM bands.

Steps

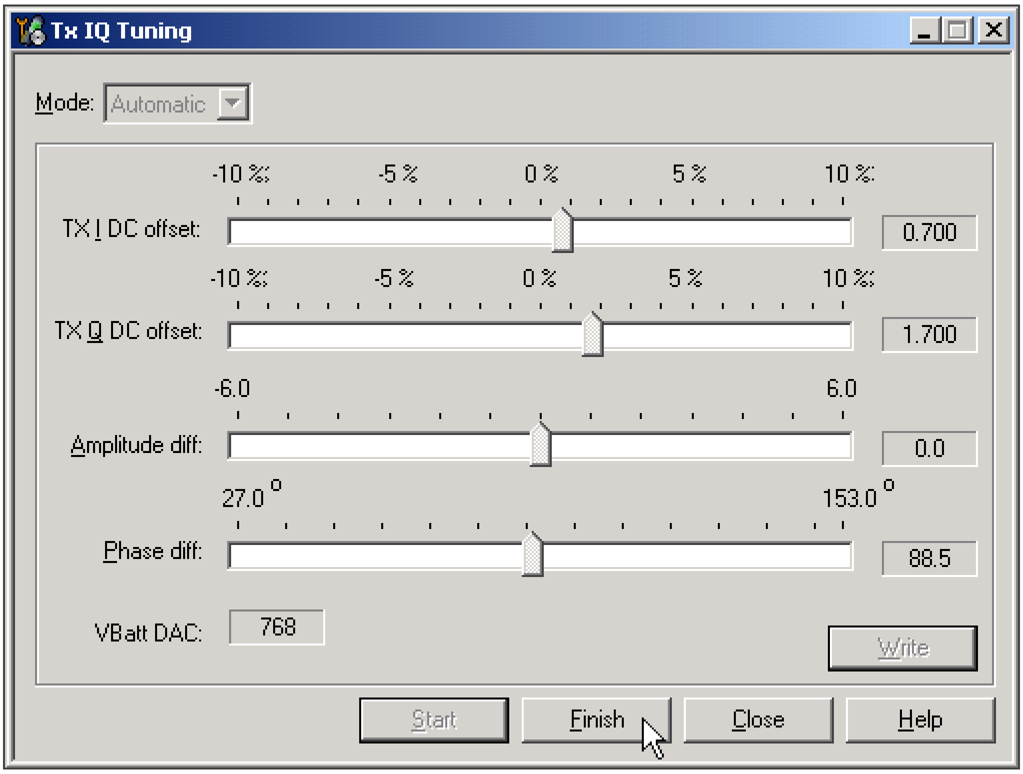
1. From the dropdown menus, set "Operating mode" to "Local" and Band to "GSM850/GSM900".
2. From the Tuning menu, choose "Tx IQ Tuning".
3. Set Mode to Automatic and Edge to Off.
4. Click Start.

   Wait until automatic tuning has finished and moved the sliders.

   Values are written to the phone memory automatically.


Tx IQ Tuning
Mode:
Automatic
-10 %
-5 %
0 %
5 %
10 %
TX I DC offset:
TX Q DC offset:
-6.0
6.0
Amplitude diff:
27.0 °
153.0 °
Phase diff:
VBatt DAC:
Write
Start
Finish
Close
Help

5. When the values have been written to the phone memory, click the Finish button to end the tuning.



Mode: Automatic

TX I DC offset: 0.700

TX Q DC offset: 1.700

Amplitude diff: 0.0

Phase diff: 88.5

VBatt DAC: 768

6. Change band to GSM1800 and repeat steps 4 to 5.
7. Change band to GSM1900 and repeat steps 4 to 5.
8. To close the tuning window, click Close.

Next action

Tuning sliders should be close to the center of the scale after the tuning and within the limits specified in the table below. If they are not within the limits, check Tx IQ quality manually.

	Min	Typ	Max	Unit
GSM850/GSM900				
I DC offset / Q DC offset	-6	-4	6	dB
Ampl	-1	0	1	dB
Phase	85	90	95	dB
GSM1800/GSM1900				
I/Q DC	-6	0.5	6	dB
Ampl	-1	0	1	dB
Phase	95	100	110	dB

Tx power level tuning

Context

Because of variations in the IC process and discrete component values, the actual transmitter RF gain of each phone is different. Tx power level tuning is used to find out mapping factors called 'power coefficients'. These factors adjust the GSM transmitter output power to fulfill the required specifications.

For EDGE transmission the bias settings of the GSM PA are adjusted in order to improve linearity. This affects the PA gain and hence the power levels have to be aligned separately for EDGE transmission.

Tx power level tuning has to be performed on all GSM bands.

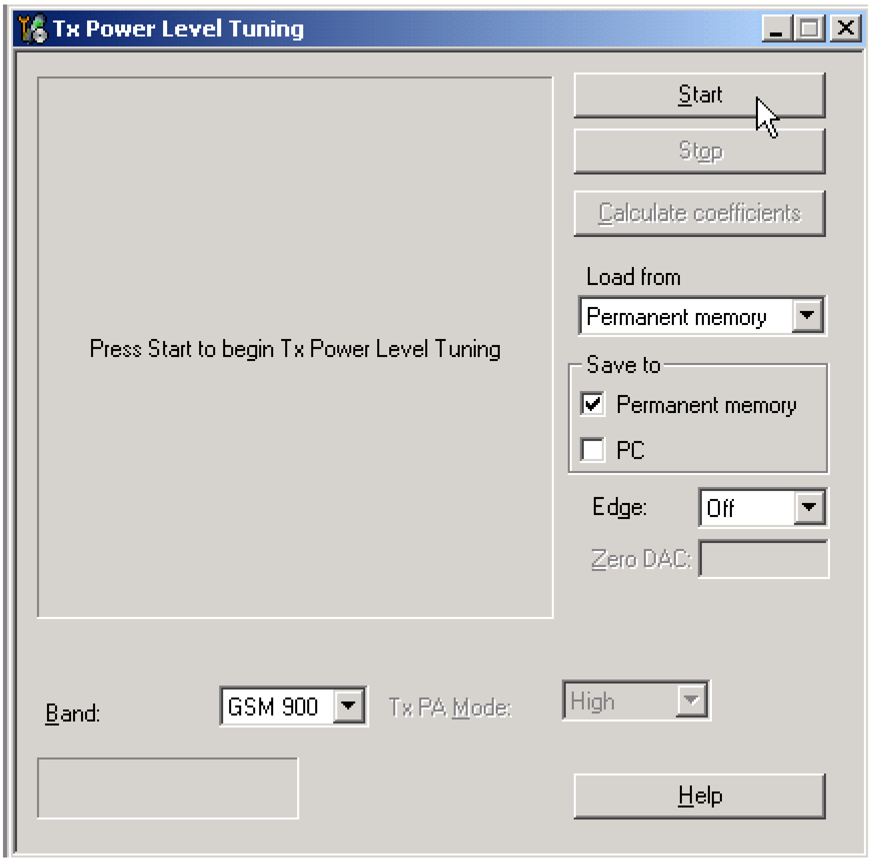
Steps

1. Connect the phone to a spectrum analyzer.
2. From the dropdown menus, set "Operating mode" to Local, "System mode" to GSM, and Band to "GSM850/GSM900".
3. From the Tuning menu, choose "Tx Power Level Tuning".
4. Set Mode to Automatic and Edge to Off.
5. Adjust the spectrum analyzer for power level tuning:

Channel frequency	GSM850: 836.6MHz
	GSM900: 897.4MHz
	GSM1800: 1747.8MHz
	GSM1900: 1880MHz
Span	0 Hz
Sweep time	2ms
Trigger	Video triggering (-10dBm)
Resolution BW	3MHz
Video BW	3MHz
Reference level offset	sum cable attenuation with module jig attenuation
Reference level	33dBm

A power meter with a peak power detector can be also used. Remember to take the attenuations into account!

6. Click Start.


Tx Power Level Tuning
Start
Stop
Calculate coefficients
Help

Press Start to begin Tx Power Level Tuning

Load from: Permanent memory

Save to:
☑ Permanent memory
☐ PC

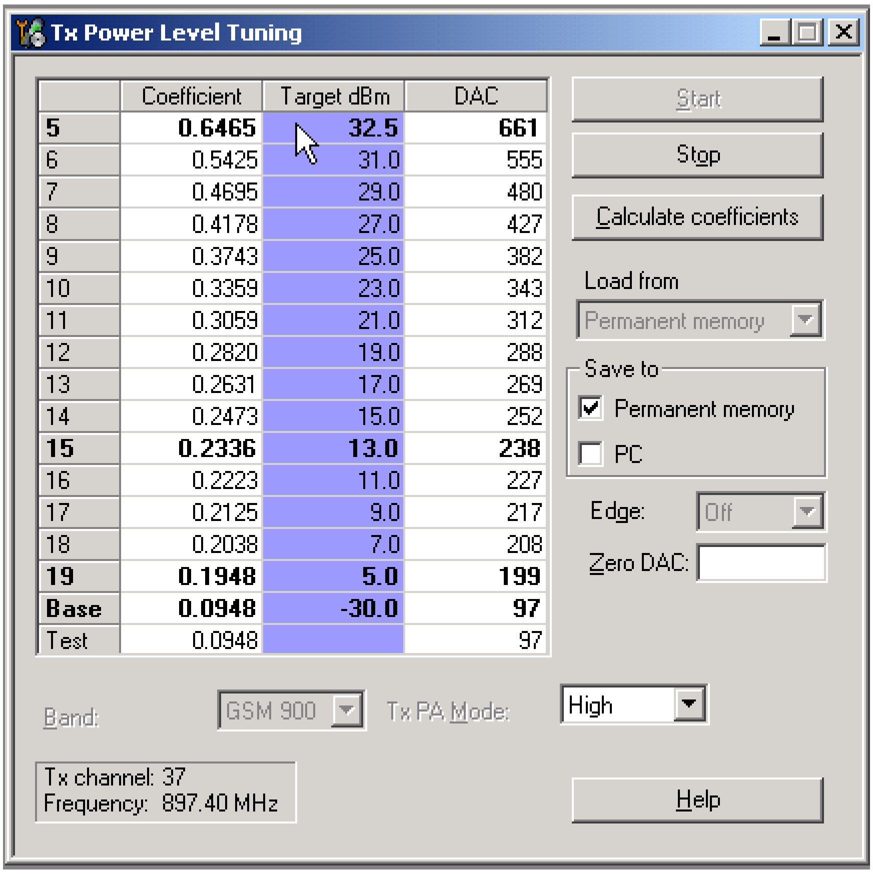
Edge: Off

Zero DAC:

Band: GSM 900

Tx PA Mode: High

7. Adjust power levels 5, 15 and 19 to correspond the "Target dBm" column by pressing + or – keys.



	Coefficient	Target dBm	DAC
5	**0.6465**	**32.5**	**661**
6	0.5425	31.0	555
7	0.4695	29.0	480
8	0.4178	27.0	427
9	0.3743	25.0	382
10	0.3359	23.0	343
11	0.3059	21.0	312
12	0.2820	19.0	288
13	0.2631	17.0	269
14	0.2473	15.0	252
15	**0.2336**	**13.0**	**238**
16	0.2223	11.0	227
17	0.2125	9.0	217
18	0.2038	7.0	208
19	**0.1948**	**5.0**	**199**
Base	**0.0948**	**-30.0**	**97**
Test	0.0948		97

Load from: Permanent memory

Save to
☑ Permanent memory
☐ PC

Edge: Off

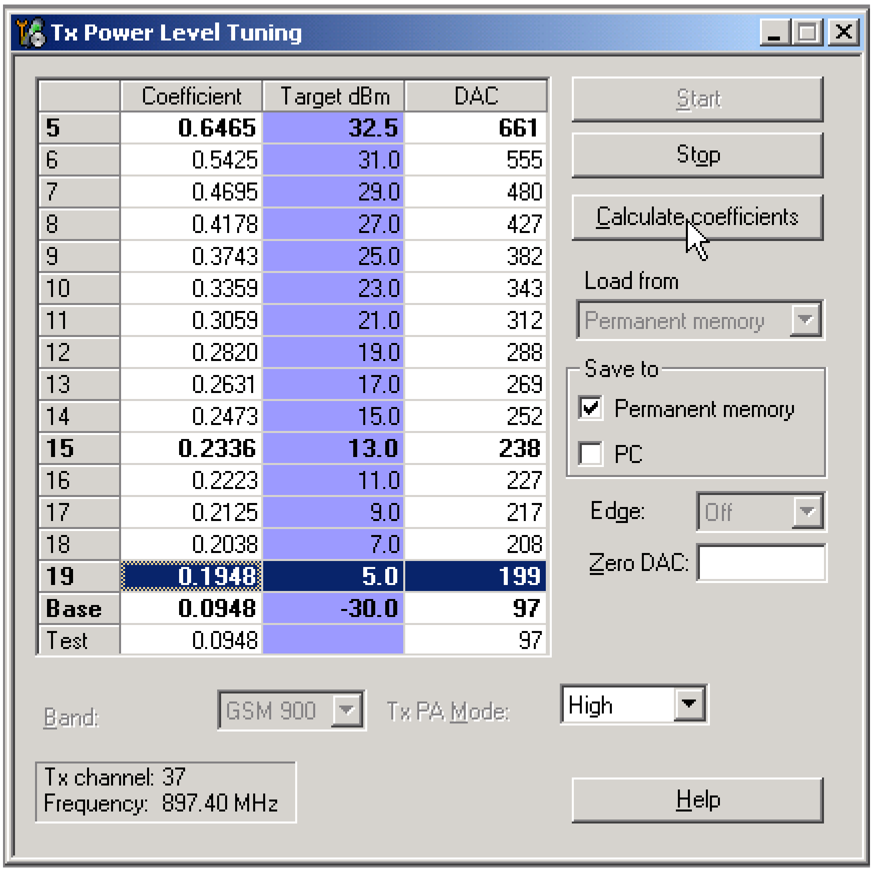
Zero DAC:

Band: GSM 900

Tx PA Mode: High

Tx channel: 37
Frequency: 897.40 MHz

8. Click "Calculate Coefficients".



	Coefficient	Target dBm	DAC
5	**0.6465**	**32.5**	**661**
6	0.5425	31.0	555
7	0.4695	29.0	480
8	0.4178	27.0	427
9	0.3743	25.0	382
10	0.3359	23.0	343
11	0.3059	21.0	312
12	0.2820	19.0	288
13	0.2631	17.0	269
14	0.2473	15.0	252
15	**0.2336**	**13.0**	**238**
16	0.2223	11.0	227
17	0.2125	9.0	217
18	0.2038	7.0	208
19	**0.1948**	**5.0**	**199**
Base	**0.0948**	**-30.0**	**97**
Test	0.0948		97

Load from: Permanent memory

Save to:
☑ Permanent memory
☐ PC

Edge: Off

Zero DAC:

Band: GSM 900

Tx PA Mode: High

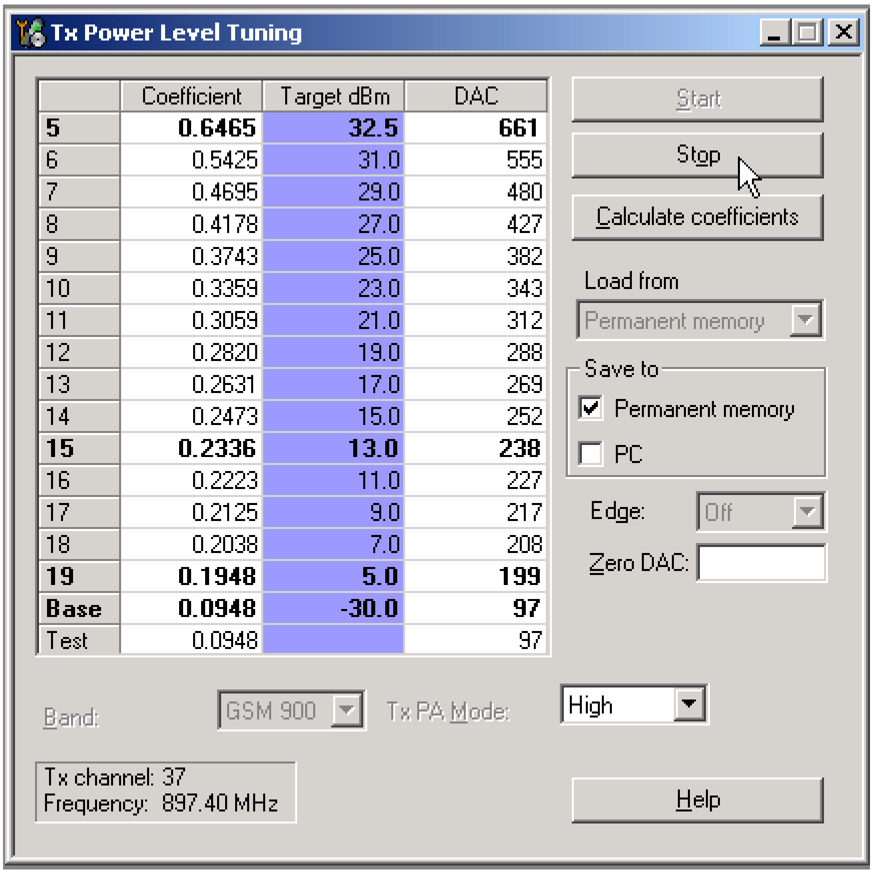
Tx channel: 37
Frequency: 897.40 MHz

9. Check that the coeffiecient values are within the limits specified in the following table.

	Min	Typ	Max
GSM850/GSM900 EDGE off			
PL5 coefficient	0.45	0.626	0.73
PL15 coefficient		0.234	
PL19 coefficient	0.12	0.195	0.3
GSM850/GSM900 EDGE on			
PL8 coefficient	0.35	0.419	0.6
PL15 coefficient		0.247	
PL19 coefficient	0.12	0.204	0.3
GSM1800 EDGE off			
PL0 coefficient	0.45	0.51	0.7
PL11 coefficient		0.219	
PL15 coefficient	0.12	0.185	0.3
GSM1800 EDGE on			
PL2 coefficient	0.35	0.394	0.6
PL11 coefficient		0.23	

	Min	Typ	Max
PL15 coefficient	0.12	0.194	0.3
GSM1900 EDGE off			
PL0 coefficient	0.45	0.482	0.7
PL11 coefficient		0.218	
PL15 coefficient	0.12	0.184	0.3
GSM1900 EDGE on			
PL2 coefficient	0.35	0.377	0.6
PL11 coefficient		0.23	
PL15 coefficient	0.12	0.193	0.3

If the values are within the limits, check that the "Save to Phone Permanent Memory" check box is checked and click Stop.


Tx Power Level Tuning
Start
Stop
Calculate coefficients
Help

	Coefficient	Target dBm	DAC
5	**0.6465**	**32.5**	**661**
6	0.5425	31.0	555
7	0.4695	29.0	480
8	0.4178	27.0	427
9	0.3743	25.0	382
10	0.3359	23.0	343
11	0.3059	21.0	312
12	0.2820	19.0	288
13	0.2631	17.0	269
14	0.2473	15.0	252
15	**0.2336**	**13.0**	**238**
16	0.2223	11.0	227
17	0.2125	9.0	217
18	0.2038	7.0	208
19	**0.1948**	**5.0**	**199**
Base	**0.0948**	**-30.0**	**97**
Test	0.0948		97

Load from: Permanent memory

Save to:
☑ Permanent memory
☐ PC

Edge: Off

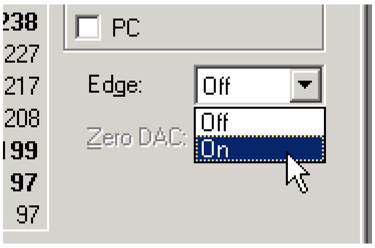
Zero DAC:

Band: GSM 900

Tx PA Mode: High

Tx channel: 37
Frequency: 897.40 MHz

10. Set **Edge** mode on and start tuning again. Change video averaging to 50.


238
227
217
208
199
97
97
☐ PC
Edge:
Off
Zero DAC:
Off
On

11. Tune EDGE power levels to the corresponding target power levels.
12. When the tuning is completed, click Stop.

Next action

Repeat steps 4 to 9 for GSM1800 and GSM1900.

Appendix A: Additional RF Troubleshooting Instructions

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1. USING THESE INSTRUCTIONS

The following sections include lots of headings and subheadings that are asking simple positive style questions.

For example heading 4.2 asks if the phone does measure RSSI-values correctly in GSM-bands. If the answer is "Yes" then user should go to the next heading on the same level (heading number that has as many decimal numbers as the heading 4.2) In our example case moving to the section 4.3. If the answer is "No" then user should go to one heading level deeper in hierarchical system meaning the section 4.2.1 in our example case.

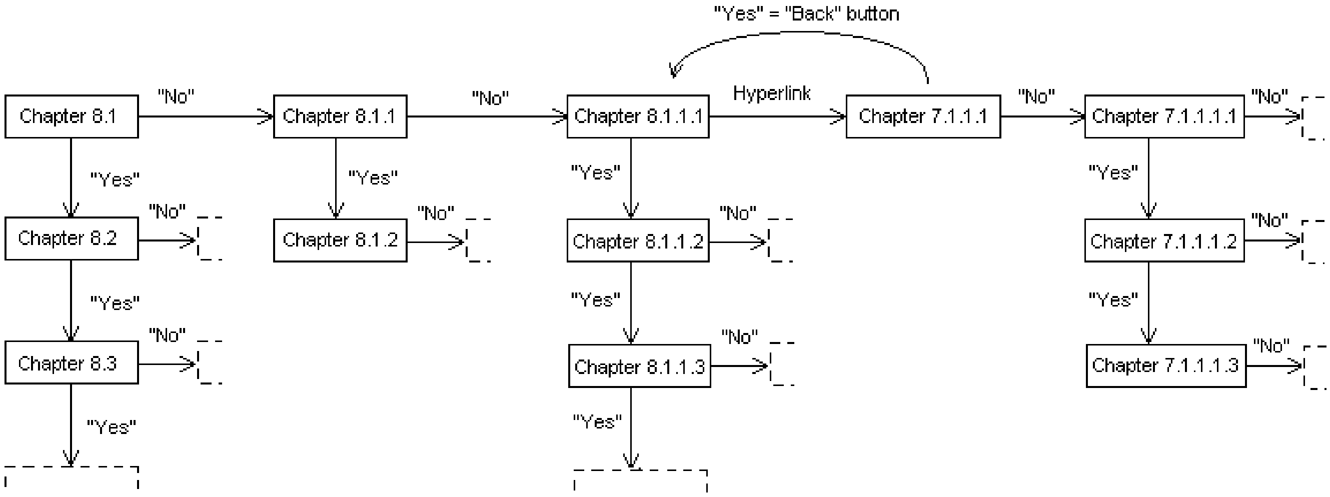
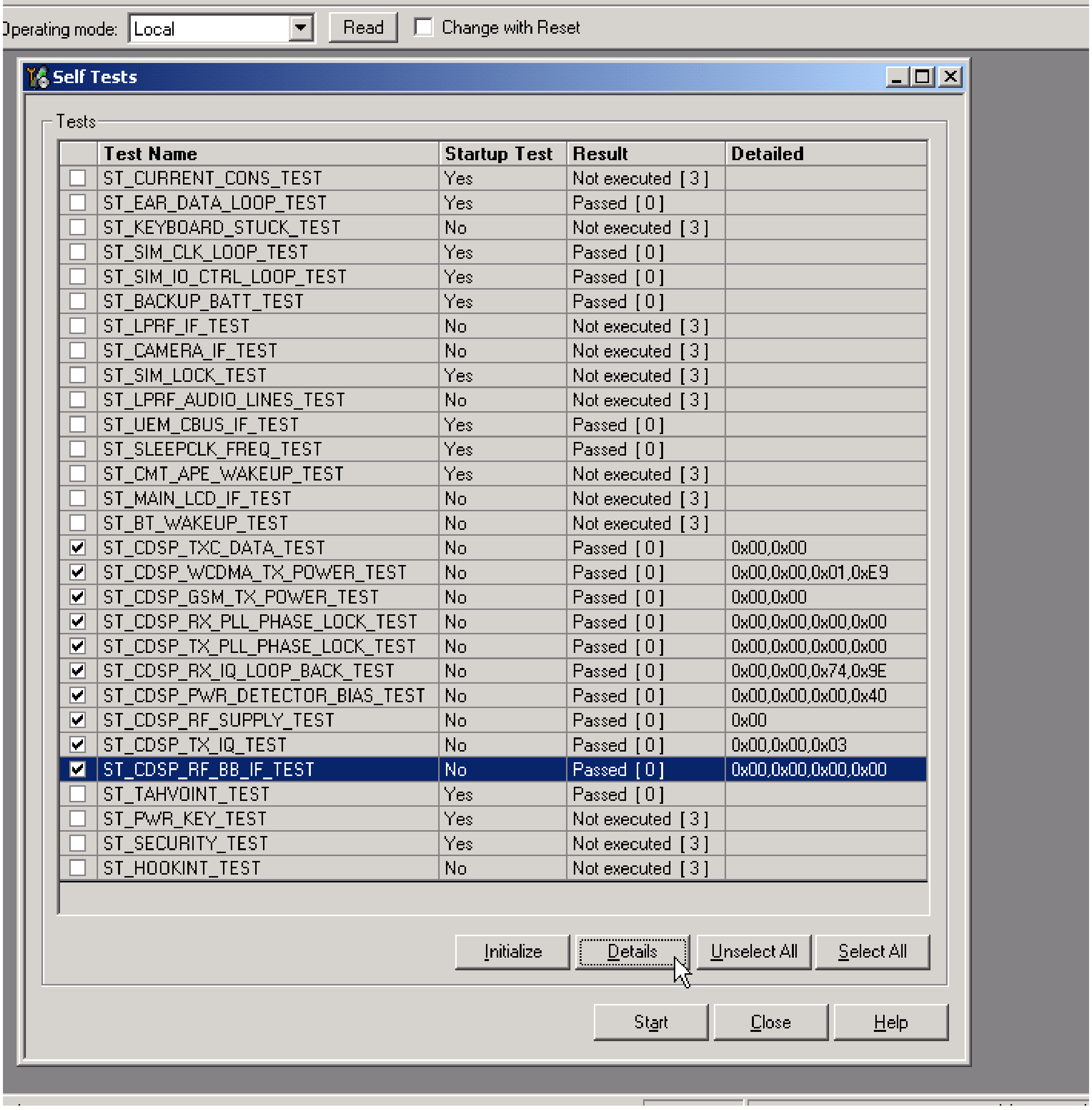

"Yes" = "Back" button
Chapter 8.1
"No"
Chapter 8.1.1
"No"
Chapter 8.1.1.1
Hyperlink
Chapter 7.1.1.1
"No"
Chapter 7.1.1.1.1
"No"
"Yes"
Chapter 8.2
"No"
"Yes"
Chapter 8.1.2
"No"
"Yes"
Chapter 8.1.1.2
"No"
"Yes"
Chapter 7.1.1.1.2
"No"
"Yes"
Chapter 8.3
"No"
"Yes"
Chapter 8.1.1.3
"No"
"Yes"
Chapter 7.1.1.1.3
"No"
"Yes"
"Yes"

Figure 1 Use of this troubleshooting manual presented with an example. Notice that real section numbers are not used.

2. RF SELF TESTS

The RF part of the device is equipped with self test functionality which tests most of RF-BB interface signals and some parts of RF circuitry. Self tests are designed to detect faults on some critical parts, but they can not prove that everything is OK even if all the self tests are passed.

Self-tests can be run with Phoenix service software. Tests can return pass/fail result and detailed measurement data and error codes in fail case. Select “Testing” -> “Self Tests” from the Phoenix menu. Select appropriate RF self tests and run them with “Start”-button. Notice that self tests should be run in “Local”-mode (change “Operating Mode” to “Local” in Phoenix before running self tests). For service tool usage instructions refer to the “Service Software” and “Service Tools and Service Concepts” sections.



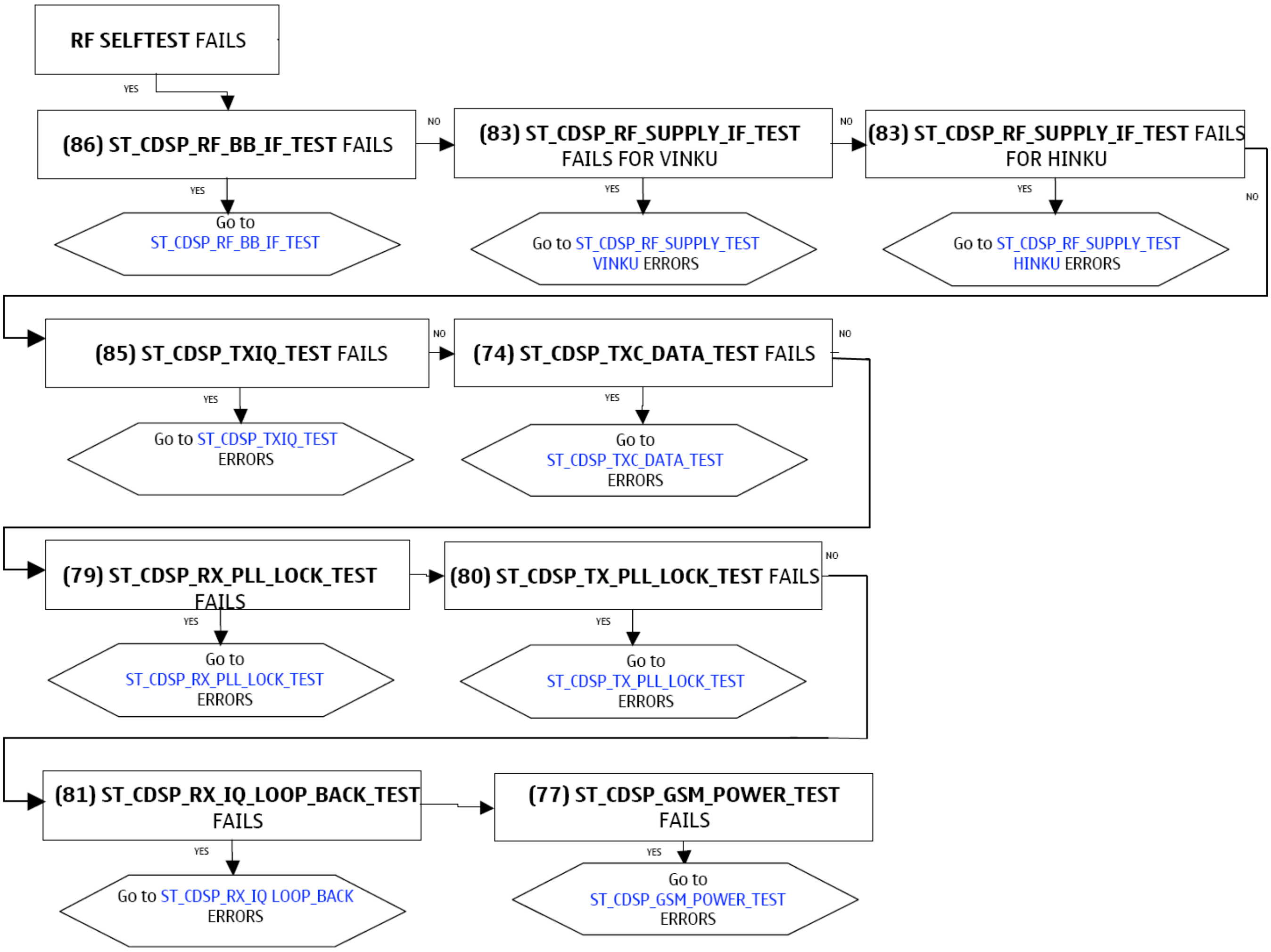
perating mode: Local

	Test Name	Startup Test	Result	Detailed
☐	ST_CURRENT_CONS_TEST	Yes	Not executed [3]	
☐	ST_EAR_DATA_LOOP_TEST	Yes	Passed [0]	
☐	ST_KEYBOARD_STUCK_TEST	No	Not executed [3]	
☐	ST_SIM_CLK_LOOP_TEST	Yes	Passed [0]	
☐	ST_SIM_IO_CTRL_LOOP_TEST	Yes	Passed [0]	
☐	ST_BACKUP_BATT_TEST	Yes	Passed [0]	
☐	ST_LPRF_IF_TEST	No	Not executed [3]	
☐	ST_CAMERA_IF_TEST	No	Not executed [3]	
☐	ST_SIM_LOCK_TEST	Yes	Not executed [3]	
☐	ST_LPRF_AUDIO_LINES_TEST	No	Not executed [3]	
☐	ST_UEM_CBUS_IF_TEST	Yes	Passed [0]	
☐	ST_SLEEPCLK_FREQ_TEST	Yes	Passed [0]	
☐	ST_CMT_APE_WAKEUP_TEST	Yes	Not executed [3]	
☐	ST_MAIN_LCD_IF_TEST	No	Not executed [3]	
☐	ST_BT_WAKEUP_TEST	No	Not executed [3]	
☑	ST_CDSP_TXC_DATA_TEST	No	Passed [0]	0x00,0x00
☑	ST_CDSP_WCDMA_TX_POWER_TEST	No	Passed [0]	0x00,0x00,0x01,0xE9
☑	ST_CDSP_GSM_TX_POWER_TEST	No	Passed [0]	0x00,0x00
☑	ST_CDSP_RX_PLL_PHASE_LOCK_TEST	No	Passed [0]	0x00,0x00,0x00,0x00
☑	ST_CDSP_TX_PLL_PHASE_LOCK_TEST	No	Passed [0]	0x00,0x00,0x00,0x00
☑	ST_CDSP_RX_IQ_LOOP_BACK_TEST	No	Passed [0]	0x00,0x00,0x74,0x9E
☑	ST_CDSP_PWR_DETECTOR_BIAS_TEST	No	Passed [0]	0x00,0x00,0x00,0x40
☑	ST_CDSP_RF_SUPPLY_TEST	No	Passed [0]	0x00
☑	ST_CDSP_TX_IQ_TEST	No	Passed [0]	0x00,0x00,0x03
☑	ST_CDSP_RF_BB_IF_TEST	No	Passed [0]	0x00,0x00,0x00,0x00
☐	ST_TAHVOINT_TEST	Yes	Passed [0]	
☐	ST_PWR_KEY_TEST	Yes	Not executed [3]	
☐	ST_SECURITY_TEST	Yes	Not executed [3]	
☐	ST_HOOKINT_TEST	No	Not executed [3]	

If one or more self tests show fail results (for example: “minor” or “fatal”) more detailed error codes can be read from the phone with “Details” button. Error codes are shown in hexadecimal format, but notice that all returned hexadecimal values are not necessarily useful in RF troubleshooting because some of the self tests return also different kind of measurement information together with “real” error codes. If self tests are not passed, please refer to following subchapters for detailed troubleshooting information.

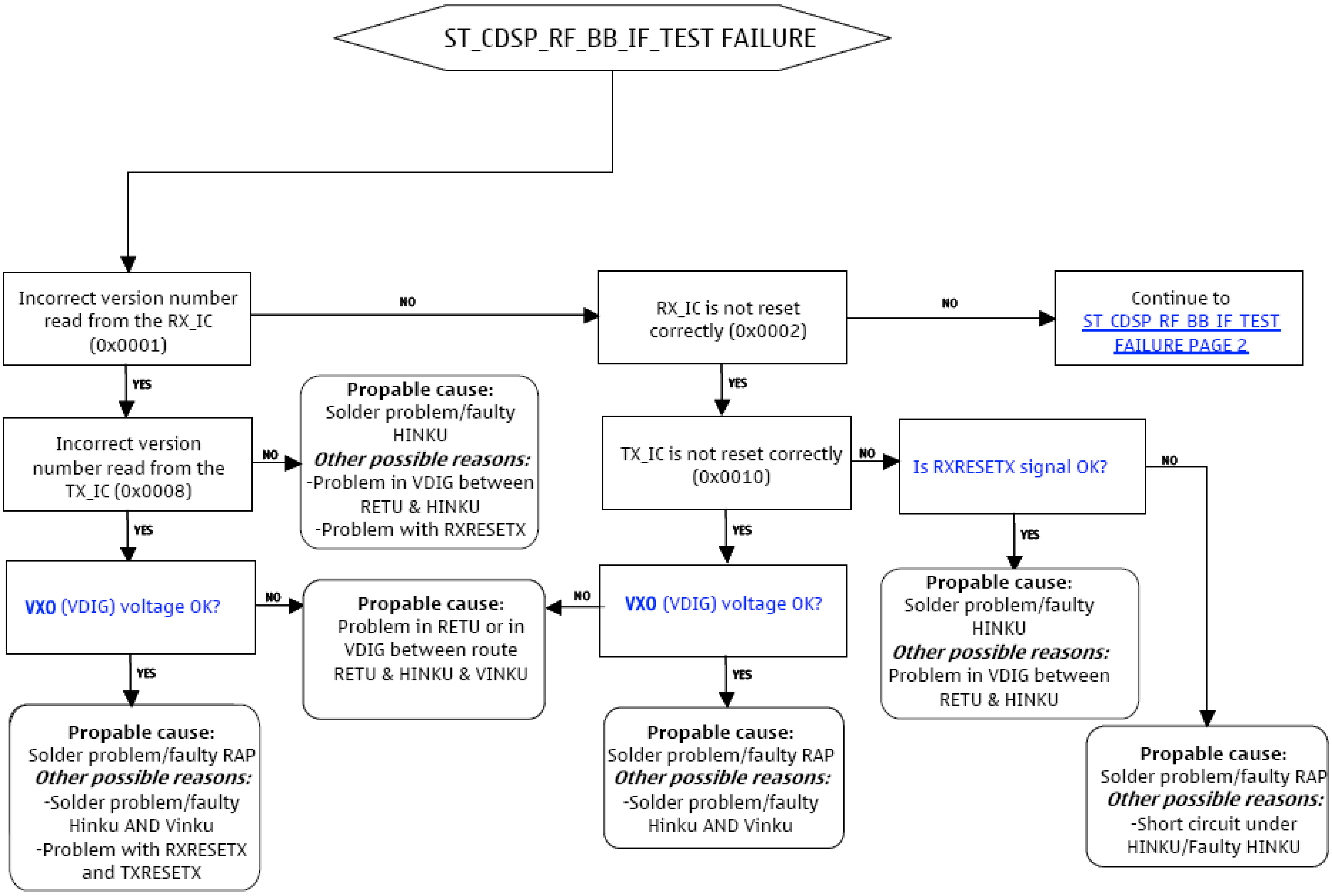
IMPORTANT!

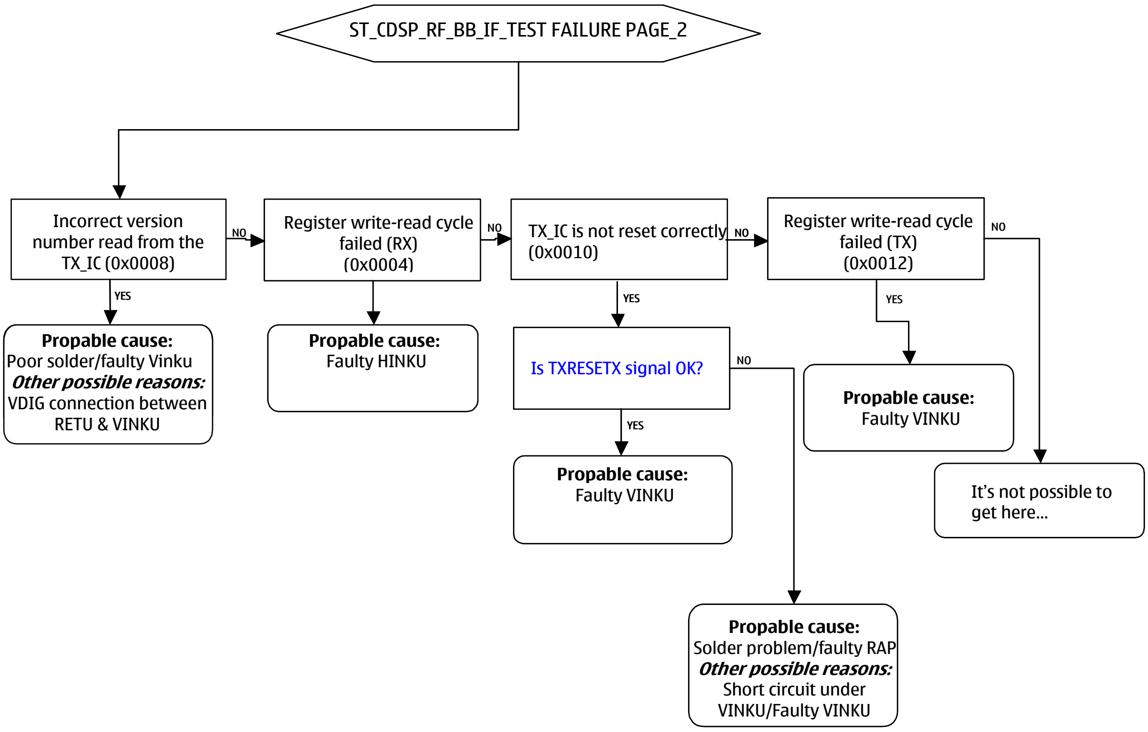
In order to use these self-tests most efficiently, it is very important that the tests are performed in certain order (or at least the error data is analyzed in this order). The tests are designed so that by performing them in this order it is easy to find the problematic component without any redundant checks. The following flowchart is based on that idea (i.e. if RFBUS fails, there is no need to spend time wondering why there is no power at TX).


RF SELFTEST FAILS
YES
(86) ST_CDSP_RF_BB_IF_TEST FAILS
NO
(83) ST_CDSP_RF_SUPPLY_IF_TEST FAILS FOR VINKU
NO
(83) ST_CDSP_RF_SUPPLY_IF_TEST FAILS FOR HINKU
NO
YES
Go to ST_CDSP_RF_BB_IF_TEST
YES
Go to ST_CDSP_RF_SUPPLY_TEST VINKU ERRORS
YES
Go to ST_CDSP_RF_SUPPLY_TEST HINKU ERRORS
(85) ST_CDSP_TXIQ_TEST FAILS
NO
(74) ST_CDSP_TXC_DATA_TEST FAILS
NO
YES
Go to ST_CDSP_TXIQ_TEST ERRORS
YES
Go to ST_CDSP_TXC_DATA_TEST ERRORS
(79) ST_CDSP_RX_PLL_LOCK_TEST FAILS
(80) ST_CDSP_TX_PLL_LOCK_TEST FAILS
NO
YES
Go to ST_CDSP_RX_PLL_LOCK_TEST ERRORS
YES
Go to ST_CDSP_TX_PLL_LOCK_TEST ERRORS
(81) ST_CDSP_RX_IQ_LOOP_BACK_TEST FAILS
(77) ST_CDSP_GSM_POWER_TEST FAILS
YES
Go to ST_CDSP_RX_IQ LOOP_BACK ERRORS
YES
Go to ST_CDSP_GSM_POWER_TEST ERRORS

2.1 RF-BB interface (ST_CDSP_RF_BB_IF_TEST)

RF_BB_IF test (86) tests the functionality of the RAP3G/HINKU/VINKU serial interface & reset lines. If this test fails, it means that there's a problem programming Hinku and or Vinku and all of the following tests cannot give correct data.


ST_CDSP_RF_BB_IF_TEST FAILURE
Incorrect version number read from the RX_IC (0x0001)
NO
RX_IC is not reset correctly (0x0002)
NO
Continue to ST_CDSP_RF_BB_IF_TEST FAILURE PAGE 2
YES
Incorrect version number read from the TX_IC (0x0008)
NO
Propable cause: Solder problem/faulty HINKU Other possible reasons: -Problem in VDIG between RETU & HINKU -Problem with RXRESETX
YES
TX_IC is not reset correctly (0x0010)
NO
Is RXRESETX signal OK?
NO
YES
VXO (VDIG) voltage OK?
NO
Propable cause: Problem in RETU or in VDIG between route RETU & HINKU & VINKU
NO
VXO (VDIG) voltage OK?
YES
Propable cause: Solder problem/faulty HINKU Other possible reasons: Problem in VDIG between RETU & HINKU
YES
Propable cause: Solder problem/faulty RAP Other possible reasons: -Solder problem/faulty Hinku AND Vinku -Problem with RXRESETX and TXRESETX
YES
Propable cause: Solder problem/faulty RAP Other possible reasons: -Solder problem/faulty Hinku AND Vinku
Propable cause: Solder problem/faulty RAP Other possible reasons: -Short circuit under HINKU/Faulty HINKU


ST_CDSP_RF_BB_IF_TEST FAILURE PAGE_2
Incorrect version number read from the TX_IC (0x0008)
NO
YES
Propable cause:
Poor solder/faulty Vinku
Other possible reasons:
VDIG connection between RETU & VINKU
Register write-read cycle failed (RX) (0x0004)
NO
Propable cause:
Faulty HINKU
TX_IC is not reset correctly (0x0010)
NO
YES
Is TXRESETX signal OK?
NO
YES
Propable cause:
Faulty VINKU
Propable cause:
Solder problem/faulty RAP
Other possible reasons:
Short circuit under VINKU/Faulty VINKU
Register write-read cycle failed (TX) (0x0012)
NO
YES
Propable cause:
Faulty VINKU
It's not possible to get here...

Please, refer to chapter Error Code Interpretation Examples if more information about error code interpretation is needed.

2.2 Supply test for Hinku and Vinku (ST_CDSP_RF_SUPPLY_TEST)

This self test includes two different RF-supply self tests...one for Vinku and one for Hinku:

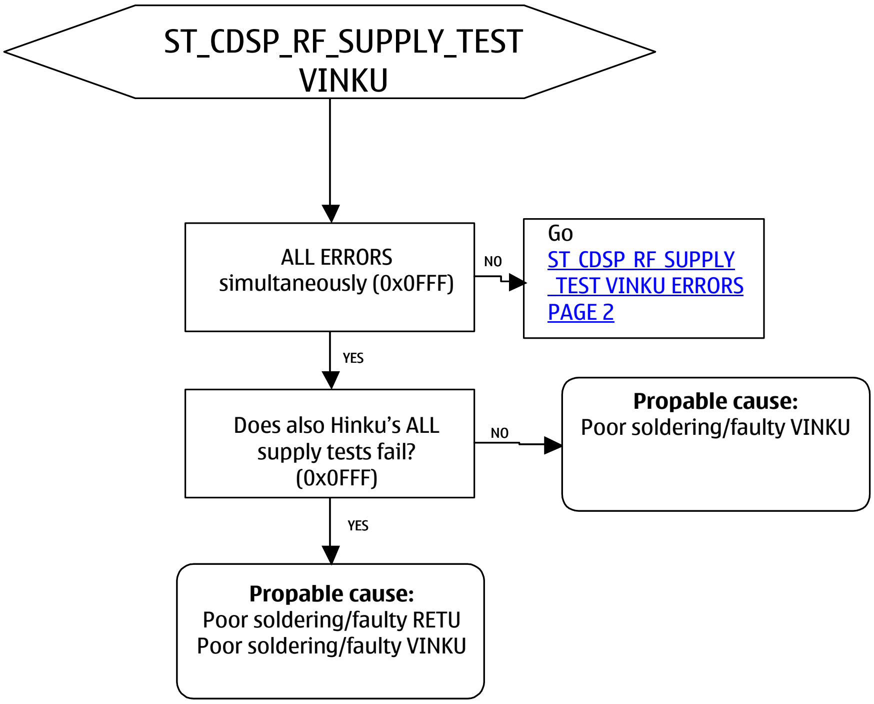
RF_SUPPLY_TEST (VINKU) (83) tests the functionality of Vinku's bias block, regulators, reference voltage line and, supply connections.
If these fail, all other Vinku tests can/will fail. Also many Hinku tests can be affected and can't be trusted.

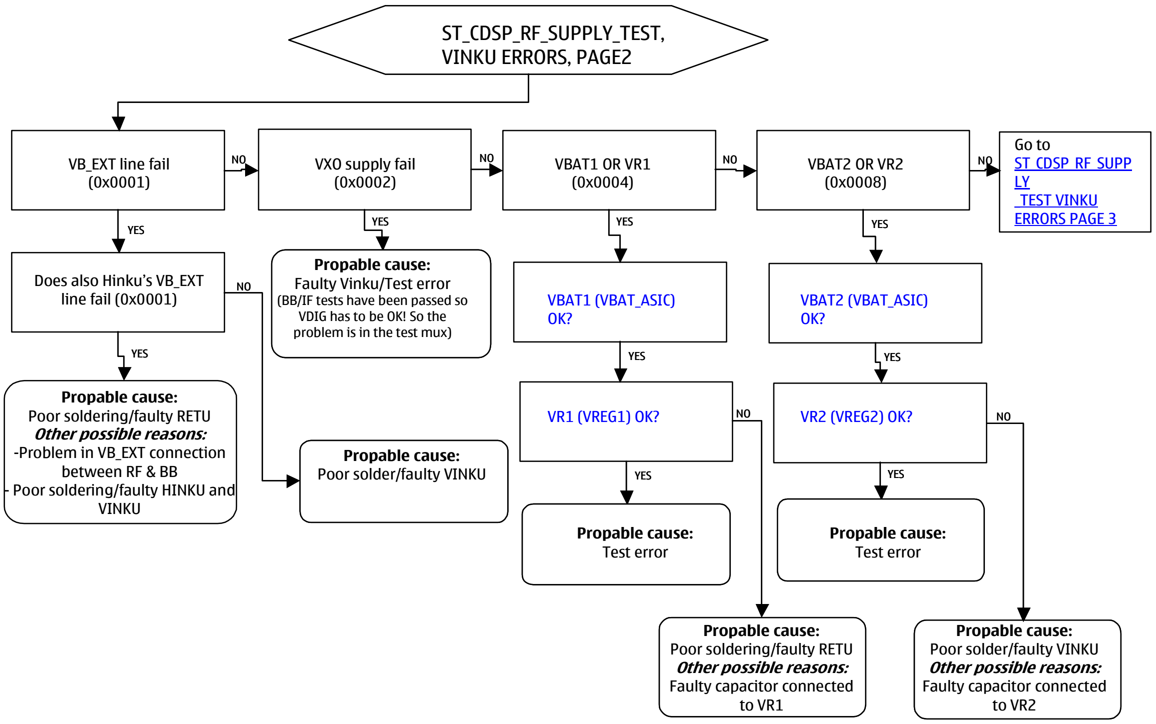
RF_SUPPLY_TEST (HINKU) (83) tests the functionality of Hinku's bias block, regulators, reference voltage line and, supply connections.
If these fail, all other Hinku tests can/will fail and can't be trusted.
Error code for this self test is given in format:

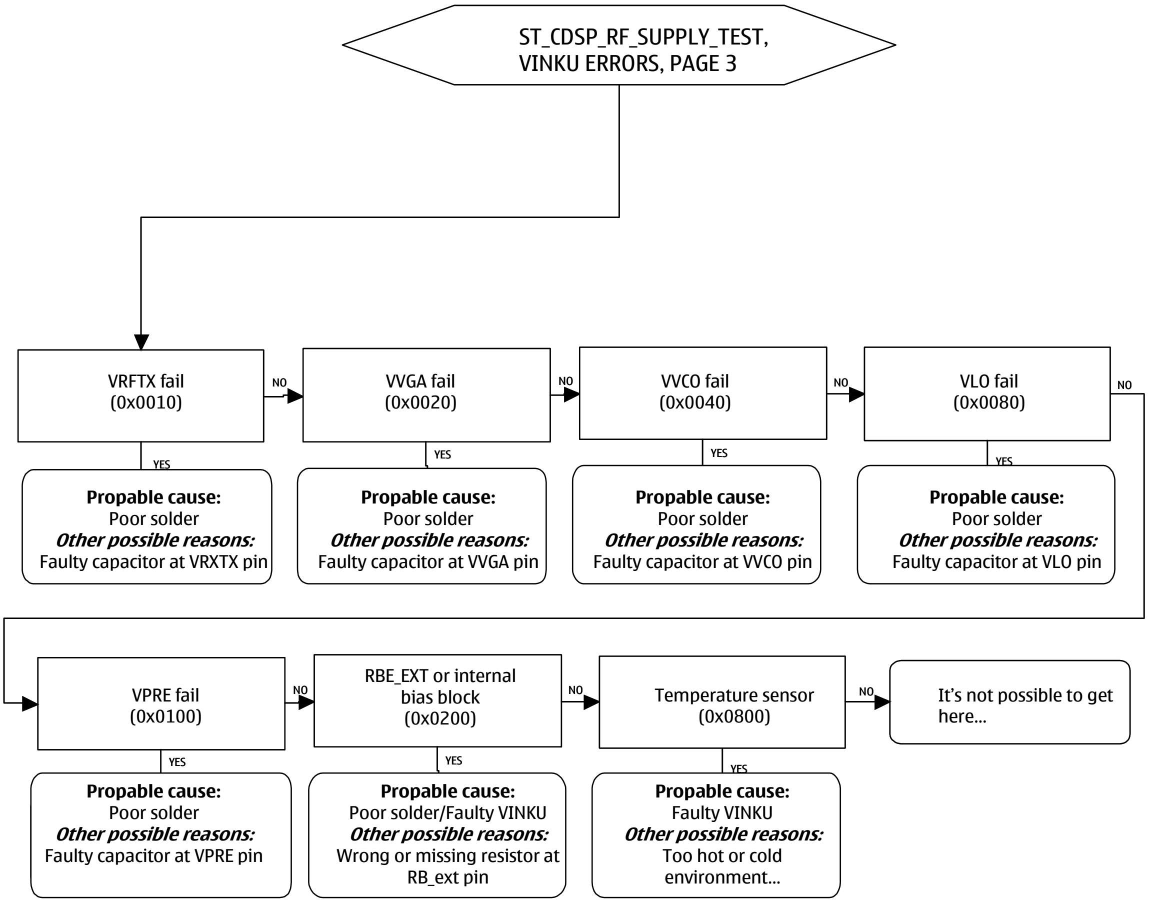
- *0xyy, 0xyy, 0xzz, 0xzz, MeasResult1, MeasResult2, ...*

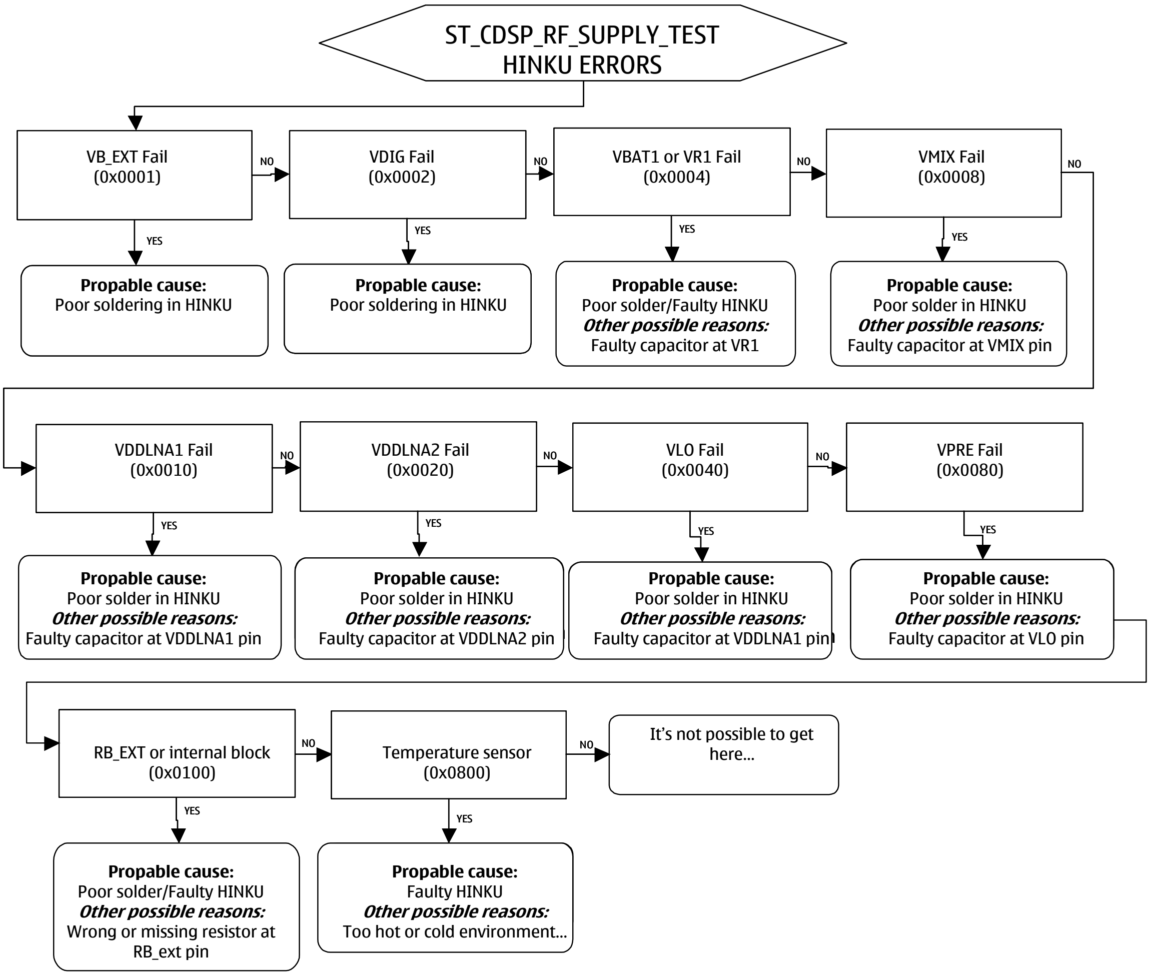
,where 0xyy, 0xyy part is the main part of the error code for Vinku TX ASIC: 0xyyyy

and 0xzz, 0xzz is the main part of the error code for Hinku TX ASIC: 0xzzzz


ST_CDSP_RF_SUPPLY_TEST VINKU
ALL ERRORS simultaneously (0x0FFF)
NO
Go ST_CDSP_RF_SUPPLY_TEST VINKU ERRORS PAGE 2
YES
Does also Hinku's ALL supply tests fail? (0x0FFF)
NO
Propable cause: Poor soldering/faulty VINKU
YES
Propable cause: Poor soldering/faulty RETU Poor soldering/faulty VINKU


ST_CDSP_RF_SUPPLY_TEST, VINKU ERRORS, PAGE2
VB_EXT line fail (0x0001)
NO
VXO supply fail (0x0002)
NO
VBAT1 OR VR1 (0x0004)
NO
VBAT2 OR VR2 (0x0008)
NO
Go to ST_CDSP_RF_SUPPLY _TEST VINKU ERRORS PAGE 3
YES
Does also Hinku's VB_EXT line fail (0x0001)
NO
YES
Propable cause: Poor soldering/faulty RETU Other possible reasons: -Problem in VB_EXT connection between RF & BB - Poor soldering/faulty HINKU and VINKU
Propable cause: Poor solder/faulty VINKU
YES
Propable cause: Faulty Vinku/Test error (BB/IF tests have been passed so VDIG has to be OK! So the problem is in the test mux)
YES
VBAT1 (VBAT_ASIC) OK?
YES
VR1 (VREG1) OK?
NO
YES
Propable cause: Test error
Propable cause: Poor soldering/faulty RETU Other possible reasons: Faulty capacitor connected to VR1
YES
VBAT2 (VBAT_ASIC) OK?
YES
VR2 (VREG2) OK?
NO
YES
Propable cause: Test error
Propable cause: Poor solder/faulty VINKU Other possible reasons: Faulty capacitor connected to VR2


ST_CDSP_RF_SUPPLY_TEST,
VINKU ERRORS, PAGE 3
VRFTX fail
(0x0010)
NO
VVGA fail
(0x0020)
NO
VVCO fail
(0x0040)
NO
VLO fail
(0x0080)
NO
YES
Propable cause:
Poor solder
Other possible reasons:
Faulty capacitor at VRXTX pin
YES
Propable cause:
Poor solder
Other possible reasons:
Faulty capacitor at VVGA pin
YES
Propable cause:
Poor solder
Other possible reasons:
Faulty capacitor at VVCO pin
YES
Propable cause:
Poor solder
Other possible reasons:
Faulty capacitor at VLO pin
VPRE fail
(0x0100)
NO
RBE_EXT or internal
bias block
(0x0200)
NO
Temperature sensor
(0x0800)
NO
It's not possible to get
here...
YES
Propable cause:
Poor solder
Other possible reasons:
Faulty capacitor at VPRE pin
YES
Propable cause:
Poor solder/Faulty VINKU
Other possible reasons:
Wrong or missing resistor at
RB_ext pin
YES
Propable cause:
Faulty VINKU
Other possible reasons:
Too hot or cold
environment...


ST_CDSP_RF_SUPPLY_TEST
HINKU ERRORS
VB_EXT Fail (0x0001)
NO
YES
Propable cause: Poor soldering in HINKU
VDIG Fail (0x0002)
NO
YES
Propable cause: Poor soldering in HINKU
VBAT1 or VR1 Fail (0x0004)
NO
YES
Propable cause: Poor solder/Faulty HINKU Other possible reasons: Faulty capacitor at VR1
VMIX Fail (0x0008)
NO
YES
Propable cause: Poor solder in HINKU Other possible reasons: Faulty capacitor at VMIX pin
VDDLNA1 Fail (0x0010)
NO
YES
Propable cause: Poor solder in HINKU Other possible reasons: Faulty capacitor at VDDLNA1 pin
VDDLNA2 Fail (0x0020)
NO
YES
Propable cause: Poor solder in HINKU Other possible reasons: Faulty capacitor at VDDLNA2 pin
VLO Fail (0x0040)
NO
YES
Propable cause: Poor solder in HINKU Other possible reasons: Faulty capacitor at VDDLNA1 pin
VPRE Fail (0x0080)
YES
Propable cause: Poor solder in HINKU Other possible reasons: Faulty capacitor at VLO pin
RB_EXT or internal block (0x0100)
NO
YES
Propable cause: Poor solder/Faulty HINKU Other possible reasons: Wrong or missing resistor at RB_ext pin
Temperature sensor (0x0800)
NO
YES
Propable cause: Faulty HINKU Other possible reasons: Too hot or cold environment...
It's not possible to get here...

Please, refer to chapter Error Code Interpretation Examples if more information about error code interpretation is needed.

2.3 TX IQ self test (ST_CDSP_TX_IQ_TEST)

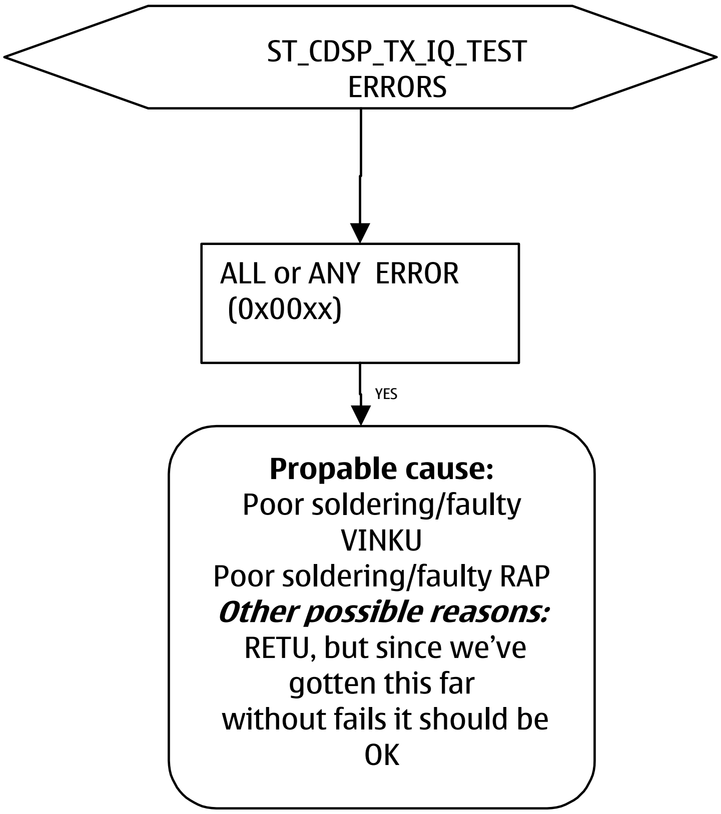
TX_IQ_TEST (85) checks that the TXIQ lines between RAP & Vinku are properly connected. If this fails also power tests and RXIQ loopback will fail.

Tested signals: VBAT_ASIC, TXIP, TXIQ, TXQP, TXQN, DAC_REF1, RFBUS

Error code for this self test is given in format:

- *0xyy, 0xzz, MeasResult1, MeasResult2, ...*

,where 0xyy, 0xzz is the main part of the error code: 0xyyzz


ST_CDSP_TX_IQ_TEST
ERRORS
ALL or ANY ERROR
(0x00xx)
YES
Propable cause:
Poor soldering/faulty VINKU
Poor soldering/faulty RAP
Other possible reasons:
RETU, but since we've gotten this far without fails it should be OK

2.4 TXC Data test (ST_TXC_DATA_TEST)

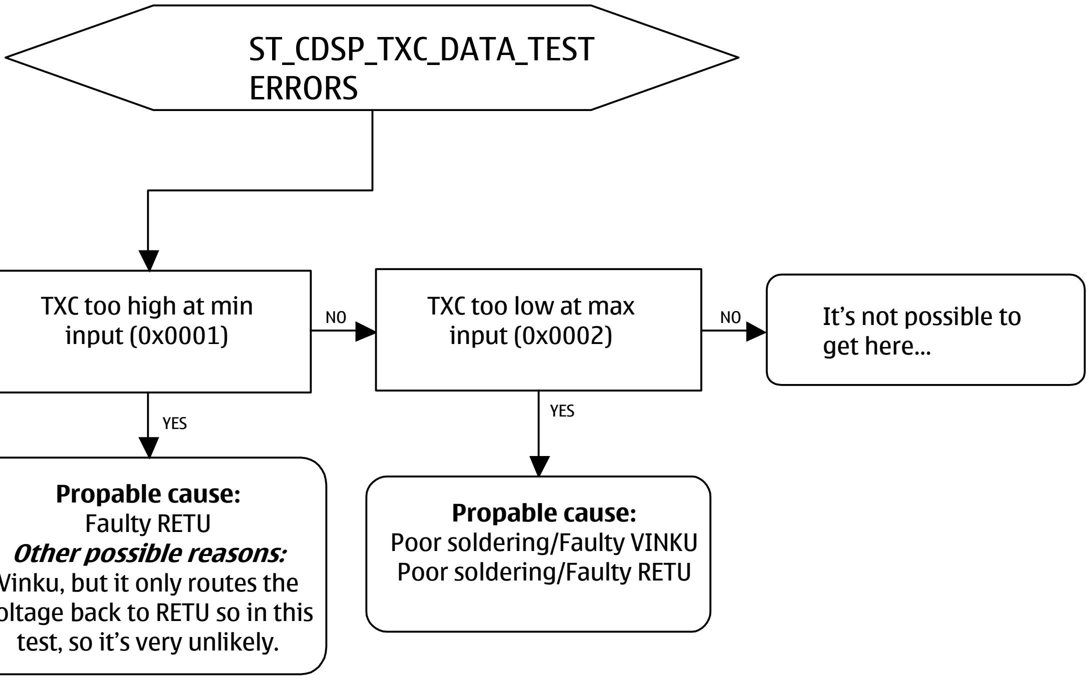
TXC_DATA_TEST (74) tests that the TXC line between RETU & VINKU is properly connected. If this fails also TX power tests will fail.

Test covers: TxC power control signal, Retu (N2200), RFBUS, Vinku (N7501), VBAT_ASIC

Error code for this self test is given in format:

- *0xyy, 0xzz, MeasResult1, MeasResult2, ...*

,where 0xyy, 0xzz part is the main part of the error code: 0xyyzz


ST_CDSP_TXC_DATA_TEST ERRORS
TXC too high at min input (0x0001)
NO
TXC too low at max input (0x0002)
NO
It's not possible to get here...
YES
Propable cause: Faulty RETU Other possible reasons: Vinku, but it only routes the voltage back to RETU so in this test, so it's very unlikely.
YES
Propable cause: Poor soldering/Faulty VINKU Poor soldering/Faulty RETU

2.5 RX PLL phase lock self test (ST_CDSP_RX_PLL_PHASE_LOCK_TEST)

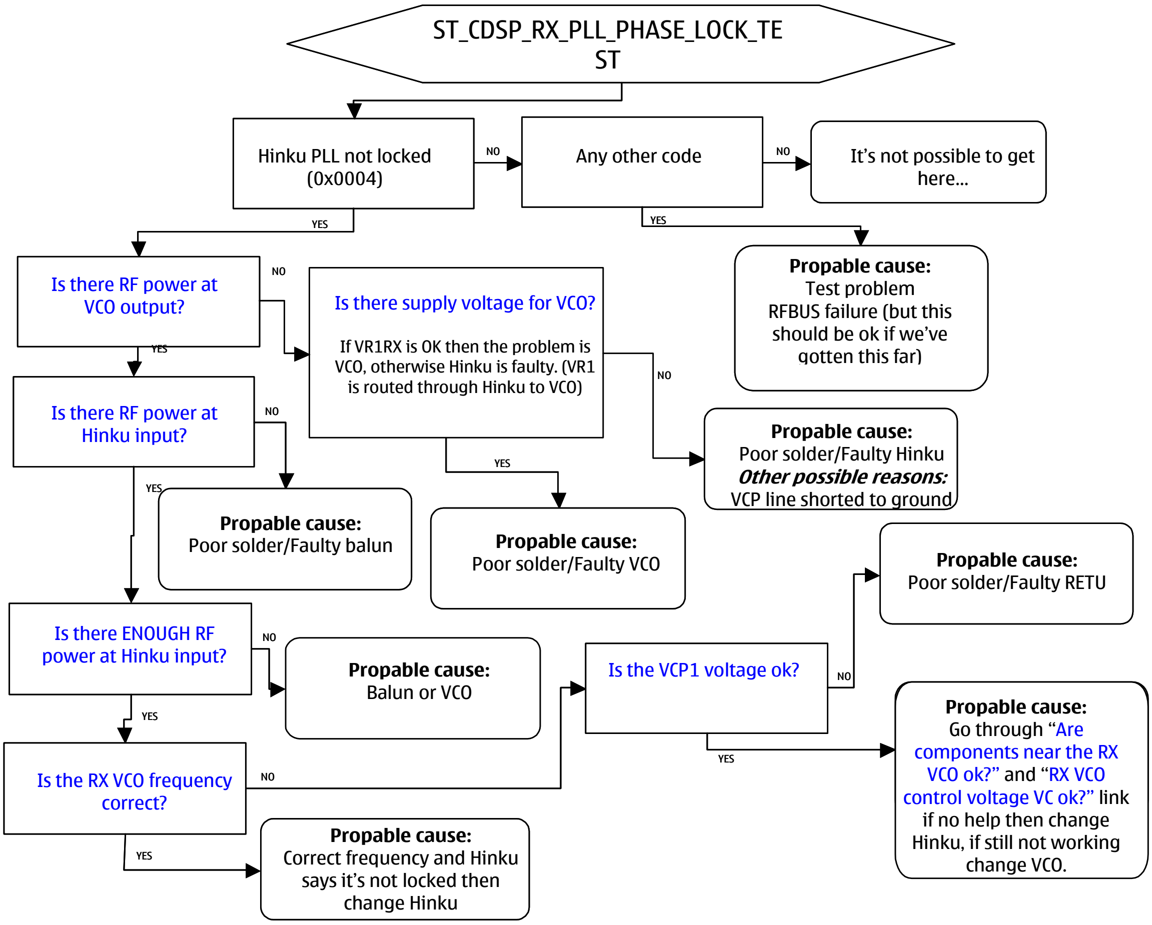
RX_PLL_LOCK_TEST (79) tests the functionality of RX PLL. If this fails, none of the RX related measurements cannot be trusted.

Tested signals: VBAT_ASIC, VDIG, VR1, VR1RX, VCP1, RFBUSDAT, RFBUSCLK, RFBUSENA, RXRESETX

Error code for this self test is given in format:

- *0xyy, 0xzz*

,where 0xyy, 0xzz part is the total error code: 0xyyzz


ST_CDSP_RX_PLL_PHASE_LOCK_TEST
Hinku PLL not locked (0x0004)
NO
Any other code
NO
It's not possible to get here...
YES
YES
Propable cause: Test problem RFBUS failure (but this should be ok if we've gotten this far)
Is there RF power at VCO output?
NO
Is there supply voltage for VCO?
If VR1RX is OK then the problem is VCO, otherwise Hinku is faulty. (VR1 is routed through Hinku to VCO)
NO
YES
Is there RF power at Hinku input?
NO
Propable cause: Poor solder/Faulty Hinku Other possible reasons: VCP line shorted to ground
YES
YES
Propable cause: Poor solder/Faulty balun
Propable cause: Poor solder/Faulty VCO
Propable cause: Poor solder/Faulty RETU
Is there ENOUGH RF power at Hinku input?
NO
Propable cause: Balun or VCO
Is the VCP1 voltage ok?
NO
YES
YES
Propable cause: Go through "Are components near the RX VCO ok?" and "RX VCO control voltage VC ok?" link if no help then change Hinku, if still not working change VCO.
Is the RX VCO frequency correct?
NO
YES
Propable cause: Correct frequency and Hinku says it's not locked then change Hinku

2.6 TX PLL phase lock self test (ST_CDSP_TX_PLL_PHASE_LOCK_TEST)

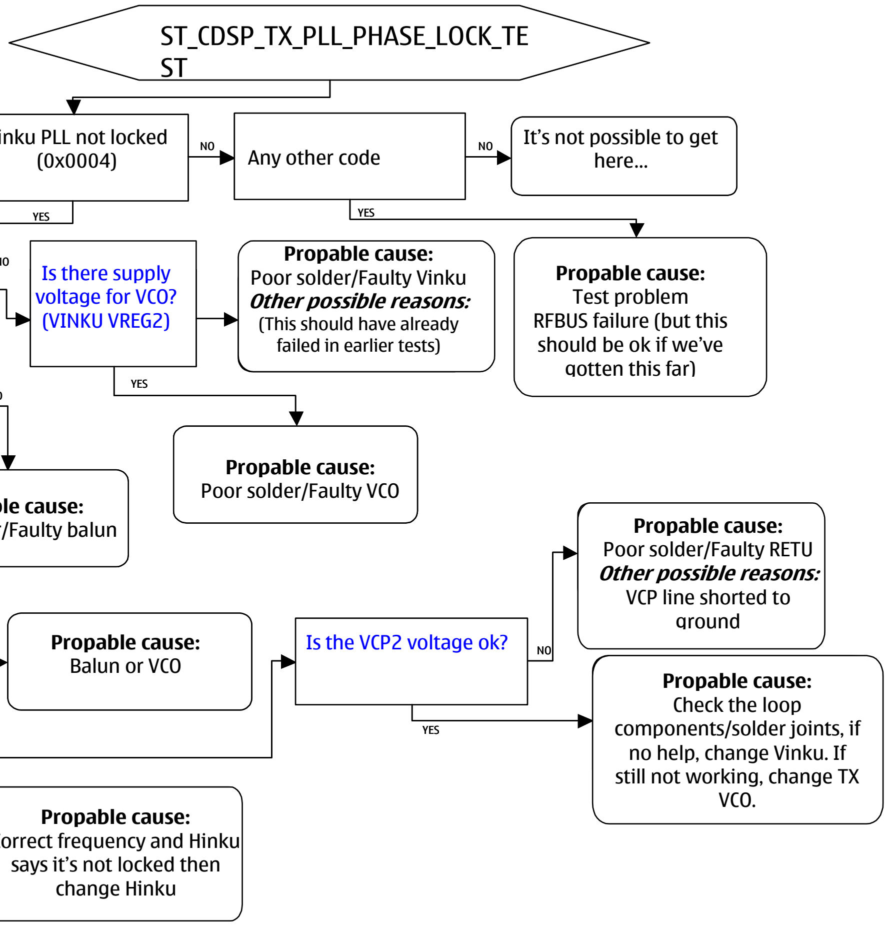
TX_PLL_LOCK_TEST (80) tests the functionality of RX PLL. If this fails also the TX power tests will fail.

Tested signals: VBAT_ASIC, VDIG, VR1, VCP2, RFBUSDAT, RFBUSCLK, RFBUSENA, TXRESETX

Error code for this self test is given in format:

- *0xyy, 0xzz*

,where 0xyy, 0xzz part is the total error code: 0xyyzz


ST_CDSP_TX_PLL_PHASE_LOCK_TEST
Vinku PLL not locked (0x0004)
NO
Any other code
NO
It's not possible to get here...
YES
YES
Is there RF power at VCO output?
NO
Is there supply voltage for VCO? (VINKU VREG2)
Propable cause: Poor solder/Faulty Vinku
Other possible reasons: (This should have already failed in earlier tests)
Propable cause: Test problem RFBUS failure (but this should be ok if we've gotten this far)
YES
YES
Is there RF power at Vinku input?
NO
Propable cause: Poor solder/Faulty VCO
YES
Propable cause: Poor solder/Faulty balun
Propable cause: Poor solder/Faulty RETU
Other possible reasons: VCP line shorted to ground
Is there ENOUGH RF power at Vinku input?
NO
Propable cause: Balun or VCO
Is the VCP2 voltage ok?
NO
Propable cause: Check the loop components/solder joints, if no help, change Vinku. If still not working, change TX VCO.
YES
YES
Is the TX VCO frequency correct?
NO
YES
Propable cause: Correct frequency and Hinku says it's not locked then change Hinku

2.7 RX IQ loop back self test (ST_CDSP_RX_IQ_LOOP_BACK_TEST)

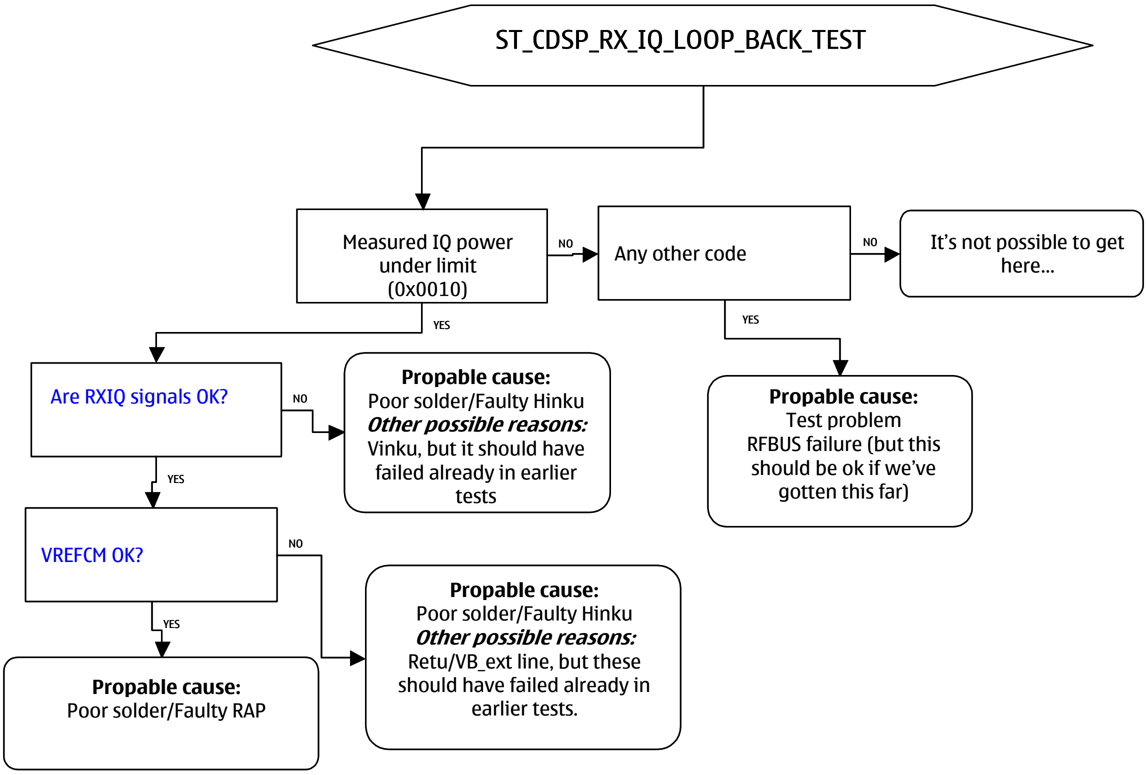
RX_IQ_LOOPBACK (81) tests that the RXI lines & VREFCM line between RAP & HINKU are connected.

Tested signals: VBAT_ASIC, RXQP, RXQN, RXIP, RXIN, VREFCM, TXIP, TXIN, RFBUS

Error code for this self test is given in format:

- *0xyy, 0xzz, MeasResult1, MeasResult2*

,where 0xyy, 0xzz part is the main part of the error code: 0xyyzz


ST_CDSP_RX_IQ_LOOP_BACK_TEST
Measured IQ power under limit (0x0010)
NO
Any other code
NO
It's not possible to get here...
YES
YES
Are RXIQ signals OK?
NO
Propable cause: Poor solder/Faulty Hinku Other possible reasons: Vinku, but it should have failed already in earlier tests
Propable cause: Test problem RFBUS failure (but this should be ok if we've gotten this far)
YES
VREFCM OK?
NO
YES
Propable cause: Poor solder/Faulty Hinku Other possible reasons: Retu/VB_ext line, but these should have failed already in earlier tests.
Propable cause: Poor solder/Faulty RAP

2.8 GSM transmitter self test (ST_CDSP_GSM_TX_POWER_TEST)

TX_GSM_POWER_TEST (77) checks the output power of the GSM transmitter.

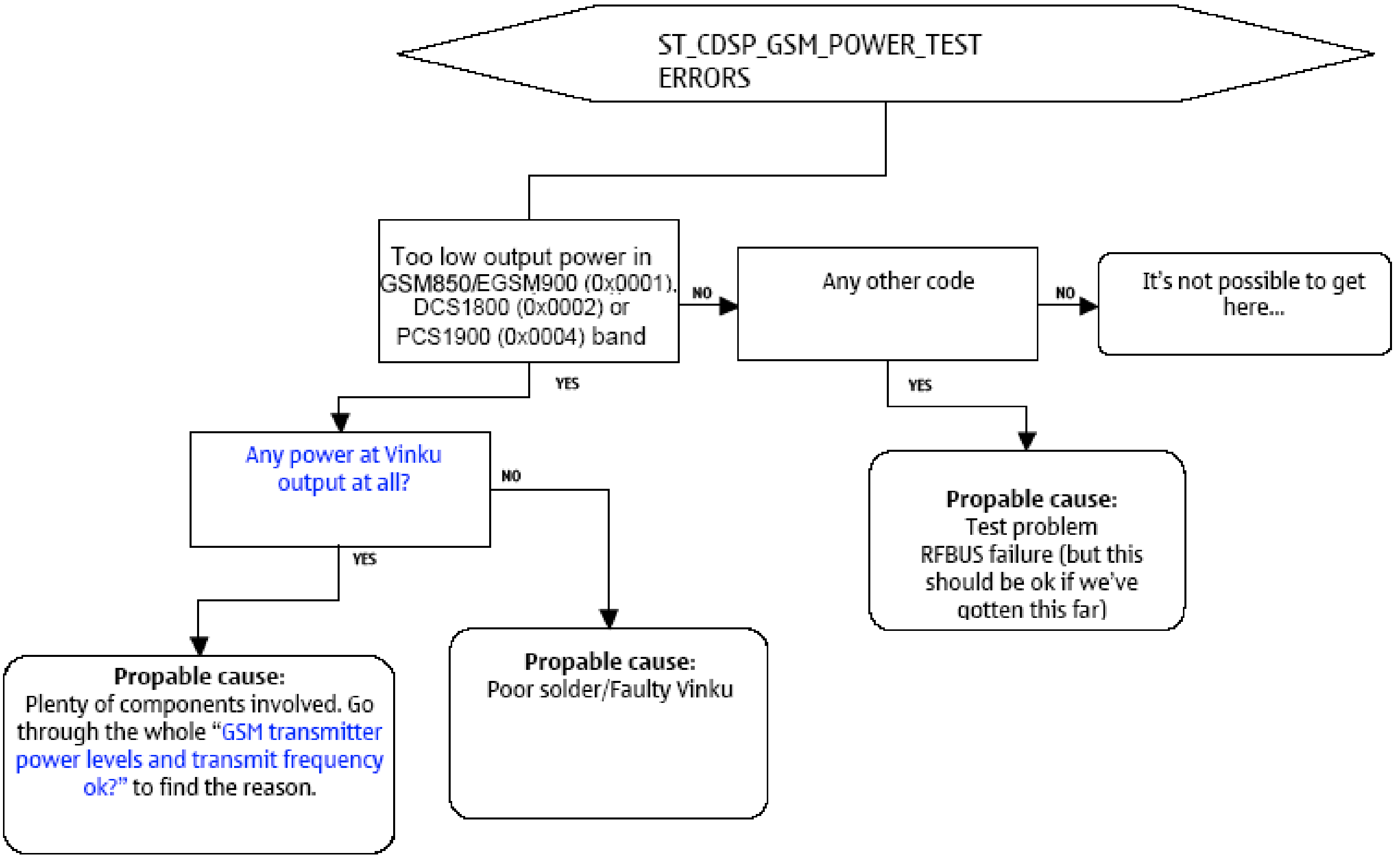
Test covers: RFIC Vinku (N7501), modulator, IC gain control stages, filter/balun solder joints, GSM PA (N7502), PA bias lines & DACs, RFBUS, TX power detector functionality, VBAT_ASIC, VBAT_PA.

Test does not cover: Antenna functionality, RX/TX-switch functionality, and TX signal quality

Error code for this self test is given in format:

- *0xyy, 0xzz, MeasResult1, MeasResult2, ...*

,where 0xyy, 0xzz part is the main part of the error code: 0xyyzz


ST_CDSP_GSM_POWER_TEST ERRORS
Too low output power in GSM850/EGSM900 (0x0001), DCS1800 (0x0002) or PCS1900 (0x0004) band
NO
Any other code
NO
It's not possible to get here...
YES
YES
Any power at Vinku output at all?
NO
Propable cause: Test problem RFBUS failure (but this should be ok if we've gotten this far)
YES
Propable cause: Plenty of components involved. Go through the whole "GSM transmitter power levels and transmit frequency ok?" to find the reason.
Propable cause: Poor solder/Faulty Vinku

2.9 Error Code Interpretation Examples

This section presents three different examples of RF error code interpretation.

2.9.1 Example 1

ST_CDSP_RX_PLL_PHASE_LOCK self test gives "Fatal" result with error code: 0x00, 0x04

This means that the total error code is "0x004" ("0000 0000 0000 0100" in binary format) and if we look a flowchart in section RX PLL phase lock self test (ST_CDSP_RX_PLL_PHASE_LOCK_TEST) the meaning for the code is *"Hinku PLL is not locked"*.

2.9.2 Example 2

Some of the self-tests can return multiple errors at the same time.

For example: RF-BB interface (ST_CDSP_RF_BB_IF_TEST) self test gives "Fatal" result with error code: 0x00, 0x09, ...

This means that the total error code without measurement values is "0x0009" and this is the same as "0000 0000 0000 1001" in binary format. If we look closer there are multiple errors (2) found:

Bit mask "---- ---- ---- ---1" = "0x0001"

Bit mask "---- ---- ---- 1---" = "0x0008"

Troubleshooting can be continued with RF-BB interface (ST_CDSP_RF_BB_IF_TEST) flowchart because there are errors with two error codes: 0x0001 and 0x0008.

2.9.3 Example 3

Supply test for Hinku and Vinku (ST_CDSP_RF_SUPPLY_TEST) is slightly different self test from others because there are both Vinku and Hinku errors shown in the same error code (*The format for error code is explained in section Supply test for Hinku and Vinku*).

For example: ST_CDSP_RF_SUPPLY_TEST gives "Fatal" result with error code: 0x0B, 0xBC, 0x00, 0x00, ...

This error code means that there are probably no errors in Hinku RX ASIC supply voltages because the main part of the error code for Hinku is 0x00, 0x00 (=0x0000) and means the same as "no errors".

Anyway, there are many errors with Vinku TX ASIC supply voltages. The main part of the error code for Vinku is 0x0B, 0xBC and that's the same as "101110111100" in binary format. If we look closer there are multiple (8) errors found:

Bit mask "---- ---- ---- -1--" = "0x0004"

Bit mask "---- ---- ---- 1---" = "0x0008"

Bit mask “---- ---- ---1 ----“ = “0x0010”

Bit mask “---- ---- --1- ----“ = “0x0020”

Bit mask “---- ---- 1--- ----“ = ”0x0080”

Bit mask “---- ---1 ---- ----“ = “0x0100”

Bit mask “---- --1- ---- ----“ = ”0x0200”

Bit mask “---- 1--- ---- ----“ = ”0x0800”

Troubleshooting can be continued with ST_CDSP_RF_SUPPLY_TEST VINKU flowchart because there are errors with eight VINKU error codes.

Typically this kind of error occurs if there is no VBAT_ASIC voltage coming to the Vinku TX ASIC at all or the ASIC is poorly soldered to the PWB (All voltages that are somehow related to VBAT_ASIC are causing errors).

3. DOES THE PHONE REGISTER TO THE NETWORK AND MAKE A CALL (GSM)?

- Test against a GSM communication tester or real GSM network with a proper SIM.

3.1 GSM transmitter power levels and transmit frequency ok?

- Attach the phone to the product specific test jig and a spectrum analyser to the RF-coupler. Coupler attenuation should be also taken into account during measurements.
- Set GSM Tx ON. Procedure is explained in section “Transmitter troubleshooting”.
- Spectrum analyser centre frequency should be set according the used TX channel (See section “Frequency mappings”).
- Spectrum analyser RBW = VBW = 1 MHz, Span 0 MHz, sweep time 1 ms. Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Test at least the maximum and minimum power levels:

- GSM850/EGSM900: The maximum power level is “5” (31 – 34 dBm, typ. value +33 dBm)

  The minimum power level is “19” (3 – 7 dBm, typ. value +5 dBm)
- GSM1800: The maximum power level is “0” (28 – 32 dBm, typ. value +30 dBm)

  The minimum power level is “15” (-2 - +2 dBm, typ. value +0 dBm)
- GSM1900: The maximum power level is “0” (28 – 32 dBm, typ. value +30 dBm)

  The minimum power level is “15” (-2 - +2 dBm, typ. value +0 dBm)

- If power is not as expected separate the phone into parts and place to the module jig. Connect the spectrum analyser to the module jig GSM RF connector and measure power levels again (*Notice that there are two antenna connectors in the module jig, one for GSM and one for Bluetooth. Make sure that all connections are made to the correct RF-connector*).

- Power levels ok in the module jig: Antenna or antenna connection bad. Replace the antenna
- Power levels still wrong or no TX signal found at all: Continue troubleshooting

- If TX signal is not found at all use wider span setting and check if the transmitter is transmitting on wrong frequency. If the signal is found to be on wrong frequency or frequency is not stabile, see section 3.1.3. "GSM transmitter frequency correct".

3.1.1 Does GSM TX transmit RF-power at all?

- If TX signal is not found at all use wider span setting and check if the transmitter is transmitting on wrong frequency. If signal is found to be on wrong frequency or frequency is not stabile, see section 3.1.3. "GSM transmitter frequency correct".

3.1.1.1 Is Vinku (N7501) transmitting RF-power at all?

- GSM transmitter has to be active before Vinku's output level can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings"). Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- GSM850/EGSM900:

- Connect the RF probe to Z7504 input. The level should be about the same on both input pins. Check output level with at least the maximum (5) and the minimum (19) power levels.
- Maximum power level – Output level should be about -15...-25 dBm
- Minimum power level – Output level should be about -45...-55 dBm

- GSM1800/GSM1900:

- Connect the RF probe to C7577 or C7575. The level should be about the same on both capacitors. Check output level with at least the maximum (0) and the minimum (15) power levels.
- Maximum power level – Output level should be about -25...-35 dBm
- Minimum power level – Output level should be about -55...-65 dBm

- Check if output levels of Vinku are as expected.
- **NOTE! If VINKU output RF-power is totally missing just in one or two GSM-bands, typically this means that Vinku ASIC (N7501) is faulty or the ASIC is badly soldered. For example: VINKU is not transmitting at all in GSM850/EGSM900-band but TX-power is ok in other GSM-bands. Then it's quite clear that VINKU (N7501) is faulty or badly soldered and the component should be replaced.**

3.1.1.1.1 RF operating voltage VBAT_ASIC?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7503 (or C7501, C7541)
- VBAT_ASIC voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

3.1.1.1.1.1 Ferrite inductor L7503 ok?

- Check that component is in place and solder joints are ok
- Measure voltage from the both ends of L7503. Is it faulty or is there short circuit in RF end?
- Disconnect the power supply from the phone and use an ohmmeter to check that inductor is conducting DC.

3.1.1.1.2 RFBUS signals ok?

- GSM receiver has to be active before RFBUS signals can be measured. Procedure is explained in section "GSM RX chain activation for manual measurements". Also WCDMA/GSM transmitter and WCDMA receiver activation can be used for the measurement but then RFBUS -signals don't necessarily look like in figures mentioned below.
- Measurements can be performed with an oscilloscope and a probe. Check all five RF BUS signals:

- *RFBUSDAT*: Connect the probe to J7504. Typical RFBUSDAT -signal is shown in section 6.5.9.3 "RFBUSDAT (GSM RX)"
- *RFBUSCLK*: Connect the probe to J7505. Typical RFBUSCLK -signal is shown in sections 6.5.9.1 "RFUSCLK (GSM RX)" and 6.5.9.2 "RFBUSCLK and RFBUSENA (GSM RX)"
- *RFBUSENA*: Connect the probe to J7506. Typical RFBUSENA -signal is shown in section 6.5.9.2 "RFBUSCLK and RFBUSENA (GSM RX)"
- *RXRESETX*: Connect the probe to J7515. RXRESETX -signal is a constant 2 V DC-signal after GSM transceiver has been activated the first time after phone boot up. The level of this signal should be about 0 V before transceiver activation.
- *TXRESETX*: Connect the probe to J7517. TXRESETX -signal is a constant 2 V DC-signal after GSM transceiver has been activated the first time after phone boot up. The level of this signal should be about 0 V before transceiver activation.

3.1.1.1.2.1 RAP3G (or Vinku or Hinku) faulty?

- RAP3G (D2800) cannot be replaced.

3.1.1.1.3 Vinku (N7501) regulator voltages VREG1, VREG2 ok?

- GSM transmitter has to be active before VREG1 and VREG2 voltages can be measured. Procedure is explained in section "Transmitter troubleshooting."
- Measurements can be done with an oscilloscope and a probe.
- VREG1: Connect the probe to C7543
- VREG2: Connect the probe to C7548 (or C7547)

- VREG1 and VREG2 voltage levels should be 2.65 – 2.86 V. Typical value is 2.7 V.

3.1.1.1.3.1 Vinku (N7501) RB_EXT voltage ok?

- GSM transmitter has to be active before Vinku's RB_EXT voltage can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7521.
- RB_EXT voltage should be 1.325 – 1.375 V.

3.1.1.1.3.1.1 VREFRF01-voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7503.
- VREFRF01 voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

3.1.1.1.3.1.1.1 Desolder R7503. Is VREFRF01 voltage still wrong?

- Remember to solder a new component to R7503 pads after the measurement.

3.1.1.1.3.1.1.1.1 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.1.1.1.3.1.1.1.2 Replace Vinku (N7501) or Hinku (N7500) or both

3.1.1.1.3.1.2 R7521 and R7504 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R7521 and R7504 resistance values with an ohmmeter.

3.1.1.1.3.1.3 VB_EXT voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7518.
- VB_EXT voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

3.1.1.1.3.1.3.1 Is R7503 in place and working correctly?

- Check that the component is in place and solder joints are ok

- Disconnect the power supply from the phone and check R7503 resistance value with an ohmmeter

3.1.1.1.3.1.3.2 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.1.1.1.3.1.3.3 Replace Vinku (N7501) or Hinku (N7500) or both

3.1.1.1.3.1.4 Replace Vinku (N7501)

3.1.1.1.3.2 Are capacitors in Vinku (N7501) regulator lines working correctly?

VREG1: C7543

VREG2: C7547, C7548, C7554, C7555, C7553, C7552, C7558 and C7567

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that regulator lines are not short-circuited to the ground. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.1.1.1.3.3 TX VCO (G7502) ok?

3.1.1.1.3.4 Replace Vinku (N7501)

3.1.1.1.4 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to C7560 (or C7526, C7513)
- VXO-voltage should be about 2.5 V

3.1.1.1.4.1 C7560, C7513, C7526 and C2214 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to find out if the VXO-line is short-circuited to the ground. If short-circuit is found replace C7560, C7513, C7526 and C2214. If replacing does not help then go to the next steps.

3.1.1.1.4.2 Replace Retu

3.1.1.1.4.3 Replace Hinku (N7500) or Vinku (N7501) or VCTCXO (G7501) or all three components

3.1.1.1.5 VCP2-voltage ok?

- GSM transmitter has to be active before VCP2 voltage can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C2221 (or C7550).
- VCP2 voltage should be about 4.75 V.

3.1.1.1.5.1 C7550 and C2221 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to find out if the VCP2-line is short-circuited to the ground. If short-circuit is found replace C7550 and C2221. If this does not help go to the next steps.

3.1.1.1.5.2 Retu ok?

3.1.1.1.5.3 Vinku (N7501) ok?

3.1.1.1.6 Is there RF power in the TX VCO output at all?

- GSM transmitter has to be active before TX VCO's output frequency and output level can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Connect the RF probe to the T7503 input. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing. *Quick VCO alive check can be done also without removing the RF shield. The RF probe should be placed as near the TX VCO output as possible (Put the head of the probe carefully inside the VCO can through the holes of the shield). Remember to use low RF Attenuator value in the spectrum analyser with this method.*
- Check if the frequency of the TX VCO is as expected. If the VCO signal is not found try to use wider span setting. The correct VCO frequency can be found in section "Frequency mappings". The output level of the VCO should be about -25 dBm during GSM TX burst.

3.1.1.1.6.1 TX VCO operating voltage VREG2 (VR2) ok?

- See section "Vinku (N7501) regulator voltages VREG1, VREG2 ok?"

3.1.1.1.6.2 Replace TX VCO (G7502)

3.1.1.1.7 Is TX VCO RF-signal coming to the Vinku at all?

- GSM transmitter has to be active before TX VCO's output level can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Check the level of the TX VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

3.1.1.1.7.1 Replace balun T7503

3.1.1.1.8 Are TX-IQ signals ok?

- These current mode signals are not possible to measure, but are tested with self-tests. So if there is no fail in 2.3. "ST_CDSP_TX_IQ_TEST" these signals should be ok. Otherwise Vinku (N7501) or RAP3G (D2800) is faulty. Notice that it is not possible to replace RAP3G ASIC.

3.1.1.1.9 Is there TXC-signal coming to Vinku ASIC (N7501)?

- GSM transmitter has to be active before TX control voltage TXC can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Set TX power level first to the maximum ("5" in GSM850/EGSM900 and "0" in GSM1800/GSM1900)
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7549
- Typical TX control voltage TXC timing should look somehow similar to figure 4.6.2 "TXC in GSM mode (DC Offset 0 V)" (GSM850/EGSM900 TX power level 5) and voltage levels should be roughly:

- GSM850/EGSM900: 1.8 V while TX burst and 0 V otherwise.
- GSM1800/GSM1900: 1.8 V while TX burst and 0 V otherwise.

- Change the TX to the minimum power level ("19" in EGSM and "15" in GSM1800/GSM1900)

- Typical TX control voltage TXC levels should be now about:

- GSM850/EGSM900: 1.0 V while TX burst and 0 V otherwise.

- GSM1800/GSM1900: 0.7 V while TX burst and 0 V otherwise.

3.1.1.1.9.1 R7514 in place?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7514 resistance value with an ohmmeter

3.1.1.1.9.2 C7549 working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that C7549is not short-circuited. If short-circuit is found replace the capacitor.

3.1.1.1.9.3 Retu ok?

3.1.1.1.10 VCTCXO frequency and output level correct?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7529 (or C7582)
- The frequency of the VCTCXO should be quite exactly 38.4 MHz and level about 0.5 - 0.9 Vpp. Example of the correct VCTCXO output signal is presented in figure 4.6.1. "VCTCXO Output (DC Offset 1.24 V)"..

3.1.1.1.10.1 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to C7560 (or C7526, C7513)
- VXO-voltage should be about 2.5 V

3.1.1.1.10.1.1 C7560, C7513, C7526 and C2214 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to find out if the VXO-line is short-circuited to the ground. If short-circuit is found replace C7560, C7513, C7526 and C2214. If replacing does not help then go to the next steps.

3.1.1.1.10.1.2 Replace Retu

3.1.1.1.10.1.3 Replace Hinku (N7500) or Vinku (N7501) or VCTCXO (G7501) or all three components

3.1.1.1.10.2 BB AFC-voltage ok?

- See section "BB AFC-voltage ok?"

3.1.1.1.10.3 Replace VCTCXO G7501

3.1.1.1.11 Replace Vinku (N7501)

3.1.1.2 Is there RF-power in the GSM PA (N7502) input at all?

- GSM transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”.
- Set TX power level to the maximum (“5” in GSM850/EGSM900 and “0” in GSM1800/GSM1900)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency settings to the spectrum analyser. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”).
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- GSM850/EGSM900: Connect the probe to J7521 (test point). The RF level should be roughly -15...-20 dBm.
- GSM1800 or GSM1900: Connect the probe to R7512 output. The RF level should be roughly -20...-30 dBm.

3.1.1.2.1 GSM850/EGSM900: Replace SAW Z7504

3.1.1.2.2 GSM1800/GSM1900: Is Vinku (N7501) output RF-signal coming to the T7502 (Balun)?

- GSM transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”. Set TX power level to the maximum (“0” in GSM1800/GSM1900)
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”).
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- GSM1800 or GSM1900: Connect the probe to T7502 input. There are two input ports in T7502 because the input port is balanced. The RF level should be roughly -25 dBm in both inputs.

3.1.1.2.2.1 Matching components ok?

GSM1800/GSM1900: C7575 and C7577

- Check that components are in place and solder joints are ok
- GSM1800 and GSM1900: Disconnect the power supply from the phone and use an ohmmeter to check that capacitors C7575 and C7577 are not short-circuited. If short-circuit is found replace the faulty capacitor.

3.1.1.2.3 GSM1800/GSM1900: Is there RF power in the balun (T7502) output at all?

- GSM transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”. Set TX power level to the maximum (“0” in GSM1800/GSM1900)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency settings to the spectrum analyser. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”).
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- GSM1800 or GSM1900: Connect the probe to R7512 input. The RF level should be roughly -20...-30 dBm.

3.1.1.2.3.1 Replace balun T7502

3.1.1.2.4 GSM1800/GSM1900: Replace attenuator R7512

3.1.1.3 Does GSM PA (N7502) transmit RF-power at all?

- GSM transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”.
- Set TX power level to the **minimum** (“19” in GSM850/EGSM900 and “15” in GSM1800/GSM1900)
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”).
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- GSM850/EGSM900: Connect the probe to J7520 (test point). The RF level should be about -16...-17 dBm.
- GSM1800 or GSM1900: Connect the probe to J7519 (test point). The RF level should be roughly -29...-30 dBm in both bands.

3.1.1.3.1 GSM PA (N7502) operating voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7593
- Voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V

3.1.1.3.1.1 PA operating voltage VBAT_PA ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7569 (or C7564, C7583)
- Voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

3.1.1.3.1.1.1 Ferrite Z7500 ok?

- Check that component is in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that inductor is conducting DC.

3.1.1.3.1.2 C7593 ok?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that the capacitor is not short-circuited. If short-circuit is found replace the capacitor.

3.1.1.3.1.3 Replace inductor L7516

- If replacing does not help, replace GSM PA (N7502)

3.1.1.3.2 Are bias currents coming correctly to the GSM PA (N7502)?

EGSM: Icont_21 and Icont_22
GSM1800/GSM1900: Icont_31 and Icont_32

- GSM transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”.
- Set TX power level to the maximum (“5” in GSM850/EGSM900 and “0” in GSM1800/GSM1900)
- Measurements can be done with an oscilloscope and a VOLTAGE probe.
- GSM850/EGSM900:

- Connect the probe to C7545 or C7544. Notice: C7544 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB.
- Typical full TX power bias currents (Icont_21 and Icont_22) should look somehow similar to figure 4.6.4 "Icont_21/Icont_22 (DC offset 1.2V)" when measured with an oscilloscope and a probe. Check both currents.

- GSM1800 or GSM1900:

- Connect the probe to C7561 or C7556. Notice: C7556 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB.

- Typical full TX power bias currents (Icont_31 and Icont_32) should look somehow similar to figure 6.5.5 when measured with an oscilloscope and a probe. Check both currents.

3.1.1.3.2.1 Vinku (N7501) RB_EXT voltage ok?

- See section "Vinku (N7501) RB_EXT voltage ok?"

3.1.1.3.2.2 Are capacitors in GSM PA (N7502) bias lines working correctly?

EGSM: Icont_21 missing – Replace Vinku
Icont_22 missing – C7545 short-circuited?
GSM1800/GSM1900: Icont_31 missing – C7556 short-circuited?
Icont_32 missing – C7561 short-circuited?

- Check that components are in place and solder joints are ok

- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.1.1.3.2.3 Replace Vinku (N7501)

3.1.1.3.3 Replace PA (N7502)

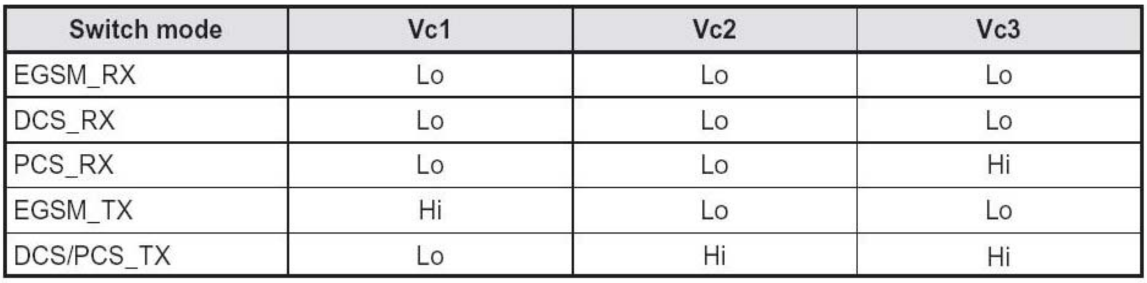
3.1.1.4 Are control voltages VC1, VC2 and VC3 coming correctly to the antenna switch (Z7503)?

- Use “RF Controls” window in Phoenix test software to activate the GSM transmitter and to select the wanted GSM band. Procedure is explained in section “Transmitter troubleshooting”. GSM RX activation is described in section “GSM RX chain activation for manual measurements”.

- Use an oscilloscope and probe to find out if antenna switch control lines are working according to table shown below. “Hi” means that there is 2.4 – 2.8 V control voltage level in the corresponding control line. “Lo” means levels 0 – 0.2 V. Remember to trigger the oscilloscope because control voltages VC1, VC2 and VC3 are pulsed

- Connect the probe to correct test points to measure VC1, VC2 and VC3 voltages (check test point locations from section “Test point locations”). Notice: these test points are PWB pads for three non-assembled capacitors.

- Note! EGSM_RX and EGSM_TX voltages are the same for GSM850.



Switch mode	Vc1	Vc2	Vc3
EGSM_RX	Lo	Lo	Lo
DCS_RX	Lo	Lo	Lo
PCS_RX	Lo	Lo	Hi
EGSM_TX	Hi	Lo	Lo
DCS/PCS_TX	Lo	Hi	Hi

3.1.1.4.1 Replace Hinku (N7500)

3.1.1.5 Replace antenna Switch Z7503

3.1.2 Does GSM TX transmit enough RF-power and power levels otherwise ok?

3.1.2.1 Is Vinku ASIC (N7501) transmitting correct RF-power?

- GSM transmitter has to be active before Vinku's output level can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings"). Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- GSM850/EGSM900:

- Connect the RF probe to Z7504 input. The level should be about the same on both input pins. Check output level with at least the maximum (5) and the minimum (19) power levels.
- Maximum power level – Output level should be about -15…-25 dBm
- Minimum power level – Output level should be about -45…-55 dBm

- GSM1800/GSM1900:

- Connect the RF probe to C7577 or C7575. The level should be about the same on both capacitors. Check output level with at least the maximum (0) and the minimum (15) power levels.
- Maximum power level – Output level should be about -25…-35 dBm
- Minimum power level – Output level should be about -55…-65 dBm

- Check if output levels of Vinku are as expected.
- **NOTE! If VINKU ASIC is transmitting wrong TX power just in one or two GSM-bands, typically this means that Vinku ASIC (N7501) is faulty or the ASIC is badly soldered. Of course**

SAW-filter Z7504 or balun T7502 can be also faulty/badly soldered and causing short-circuit, but probability to this is quite low. For example: VINKU is transmitting too low power in GSM850/EGSM900-band but TX-power is ok in other GSM-bands. Then it's almost clear that VINKU (N7501) is faulty or badly soldered and the component should be replaced.

3.1.2.1.1 RF operating voltage VBAT_ASIC ok?

- See section "RF operating voltage VBAT_ASIC ok?"

3.1.2.1.2 Are Vinku (N7501) regulator voltages VREG1, VREG2 ok?

- GSM transmitter has to be active before VREG1 and VREG2 voltages can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with an oscilloscope and a probe.
- VREG1: Connect the probe to C7543
- VREG2: Connect the probe to C7548 (or C7547)
- VREG1 and VREG2 voltage levels should be 2.65 – 2.86 V. Typical value is 2.7 V.

3.1.2.1.2.1 Vinku (N7501) RB_EXT voltage ok?

- GSM transmitter has to be active before Vinku's RB_EXT voltage can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7521.
- RB_EXT voltage should be 1.325 – 1.375 V.

3.1.2.1.2.1.1 VREFRF01-voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7503.
- VREFRF01 voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

3.1.2.1.2.1.1.1 Desolder R7503. Is VREFRF01 voltage still wrong?

- Remember to solder a new component to R7503 pads after the measurement.

3.1.2.1.2.1.1.1.1 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.1.2.1.2.1.1.1.2 Replace Vinku (N7501) or Hinku (N7500) or both

3.1.2.1.2.1.2 R7521 and R7504 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R7521 and R7504 resistance values with an ohmmeter.

3.1.2.1.2.1.3 VB_EXT voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7518.
- VB_EXT voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

3.1.2.1.2.1.3.1 Is R7503 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7503 resistance value with an ohmmeter

3.1.2.1.2.1.3.2 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.1.2.1.2.1.3.3 Replace Vinku (N7501) or Hinku (N7500) or both

3.1.2.1.2.2 Replace Vinku (N7501)

3.1.2.1.3 Are TX-IQ signal waveforms looking correct?

- These current mode signals are not possible to measure, but are tested with self-tests. So if there is no fail in 2.3 ST_CDSP_TX_IQ_TEST these signals should be ok. Otherwise Vinku (N7501) or RAP3G (D2800) is faulty. Notice that it is not possible to replace RAP3G ASIC.

3.1.2.1.4 Is the TXC-signal coming to Vinku ASIC (N7501) OK? Is signal level correct?

- GSM transmitter has to be active before TX control voltage TXC can be measured. Procedure is explained in section “Transmitter troubleshooting”.
- Set TX power level first to the maximum (“5” in GSM850/EGSM900 and “0” in GSM1800/GSM1900)
- Measurement can be done with an oscilloscope and a probe.

- Connect the probe to C7549
- Typical TX control voltage TXC timing should look somehow similar to figure 4.6.2 "TXC in GSM mode (DC offset 0 V)" (GSM850/EGSM900 TX power level 5) and voltage levels should be roughly:

- GSM850/EGSM900: 1.8 V while TX burst and 0 V otherwise.
- GSM1800/GSM1900: 1.8 V while TX burst and 0 V otherwise.

- Change the TX to the minimum power level ("19" in EGSM and "15" in GSM1800/GSM1900)
- Typical TX control voltage TXC levels should be now about:

- GSM850/EGSM900: 1.0 V while TX burst and 0 V otherwise.

- GSM1800/GSM1900: 0.7 V while TX burst and 0 V otherwise.

3.1.2.1.4.1 R7514 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R514 resistance value with an ohmmeter

3.1.2.1.4.2 C7549 working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check with an ohmmeter that C7549 is not short-circuited.

3.1.2.1.4.3 Retu ok?

3.1.2.1.5 Does GSM PA (N7502) get correct DET_SW_G -voltage from Vinku ASIC (N7501)?

- GSM transmitter has to be active before DET_SW_G voltage can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7595 pad. Notice: C7595 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB.
- DET_SW_G voltage should be about 2.8 V while TX burst and 0 V otherwise.

3.1.2.1.5.1 Replace Vinku (N7501)

3.1.2.1.6 Are components in GSM power control loop in place and working ok?

R7516 and C7559

- Disconnect the power supply from the phone and use an ohmmeter to check that C7559 is not short-circuited. If short-circuit is found replace the capacitor.

- Check R7516 resistance value with an ohmmeter and replace resistor if needed.

3.1.2.1.7 Is TX VCO signal level in the T7503 output high enough?

- GSM transmitter has to be active before TX VCO's output level can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings"). Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Check the level of the VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines during GSM TX burst. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

3.1.2.1.7.1 TX VCO G7502 output level high enough?

- GSM transmitter has to be active before TX VCO's output frequency and output level can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Connect the RF probe to the T7503 input. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.
- Check if the frequency of the TX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -25 dBm during GSM TX burst.

3.1.2.1.7.1.1 Replace TX VCO G7502

3.1.2.1.7.2 Replace balun T7503

3.1.2.1.8 Replace Vinku (N7501) or GSM PA (N7502)

- If the output level of Vinku is higher than wanted then replace GSM PA (N7502). Otherwise replace TX ASIC Vinku (N7501).

3.1.2.2 Does GSM PA (N7502) have enough RF-power in its input?

- GSM transmitter has to be active before measurements. Procedure is explained in section "Transmitter troubleshooting".
- Set TX power level to the maximum ("5" in GSM850/EGSM900 and "0" in GSM1800/GSM1900)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency settings to the spectrum analyser. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- GSM850/EGSM900: Connect the probe to J7521 (test point). The RF level should be roughly -15...-20 dBm.
- GSM1800 or GSM1900: Connect the probe to R7512 output. The RF level should be roughly -20...-30 dBm.

3.1.2.2.1 GSM850/EGSM900: Replace SAW Z7504

3.1.2.2.2 GSM1800/GSM1900: Is Vinku (N7501) output RF-signal coming correctly to the T7502 (Balun)?

- GSM transmitter has to be active before measurements Procedure is explained in section "Transmitter troubleshooting".
- Set TX power level to the maximum ("0" in GSM1800/GSM1900)
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- GSM1800 or GSM1900: Connect the probe to T7502 input. There are two input ports in T7502 because the input port is balanced. The RF level should be roughly -25 dBm in both inputs.

3.1.2.2.2.1 Matching components ok?

GSM1800/GSM1900: C7575 and C7577

- Check that components are in place and solder joints are ok
- GSM1800 and GSM1900: Disconnect the power supply from the phone and use an ohmmeter to check that capacitors C7575 and C7577 are not short-circuited. If short-circuit is found replace the faulty capacitor.

3.1.2.2.3 GSM1800/GSM1900: Is there correct RF power in the balun (T7502) output?

- GSM transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”.
- Set TX power level to the maximum (“0” in GSM1800/GSM1900)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency settings to the spectrum analyser. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”).
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- GSM1800 or GSM1900: Connect the probe to R7512 input. The RF level should be roughly -20...-30 dBm.

3.1.2.2.3.1 Replace balun T7502

3.1.2.2.4 GSM1800/GSM1900: Replace attenuator R7512

3.1.2.3 GSM PA (N7502) transmitting correct RF-power?

- GSM transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”.
- Set TX power level to the **minimum** (“19” in GSM850/EGSM900 and “15” in GSM1800/GSM1900)
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”).
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- GSM850/EGSM900: Connect the probe to J7520 (test point). The RF level should be about -16...-17 dBm.
- GSM1800 or GSM1900: Connect the probe to J7519 (test point). The RF level should be roughly -29...-30 dBm in both bands.

3.1.2.3.1 GSM PA (N7502) operating voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7593
- Voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

3.1.2.3.1.1 PA operating voltage VBAT_PA ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7569 (or C7564, C7583)
- Voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

3.1.2.3.1.1.1 Ferrite Z7500 ok?

- Check that component is in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that inductor is conducting DC.

3.1.2.3.1.2 C7593 ok?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that the capacitor is not short-circuited. If short-circuit is found replace the capacitor.

3.1.2.3.1.3 Replace inductor L7516

- If replacing doesn't help then replace GSM PA (N7502)

3.1.2.3.2 Are bias currents coming correctly to the GSM PA (N7502)? Level ok?

EGSM: Icont_21 and Icont_22
GSM1800/GSM1900: Icont_31 and Icont_32

- GSM transmitter has to be active before measurements. Procedure is explained in section "Transmitter troubleshooting".
- Set TX power level to the maximum ("5" in GSM850/EGSM900 and "0" in GSM1800/GSM1900)
- Measurements can be done with an oscilloscope and a VOLTAGE probe.
- GSM850/EGSM900:
  - Connect the probe to C7545 or C7544. Notice: C7544 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB
  - Typical full TX power bias currents (Icont_21 and Icont_22) should look somehow similar to figure 4.6.4 "Icont_21/Icont_22 (DC Offset 1.2 V)" when measured with an oscilloscope and a probe. Check both currents.
- GSM1800 or GSM1900:
  - Connect the probe to C7561 or C7556. Notice: C7556 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB
  - Typical full TX power bias currents (Icont_31 and Icont_32) should look somehow similar to figure 6.5.5 "Icont_31/Icont_32 (DC Offset 1.2 V)" when measured with an oscilloscope and a probe. Check both currents.

3.1.2.3.2.1 Vinku (N7501) RB_EXT voltage ok?

- See section "Vinku (N7501) RB_EXT voltage ok?"

3.1.2.3.2.2 Are capacitors in GSM PA (N7502) bias lines working correctly?

EGSM: Icont_21 missing – Replace Vinku
Icont_22 missing – C7545 short-circuited?
GSM1800/GSM1900: Icont_31 missing – C7556 short-circuited?
Icont_32 missing – C7561 short-circuited?

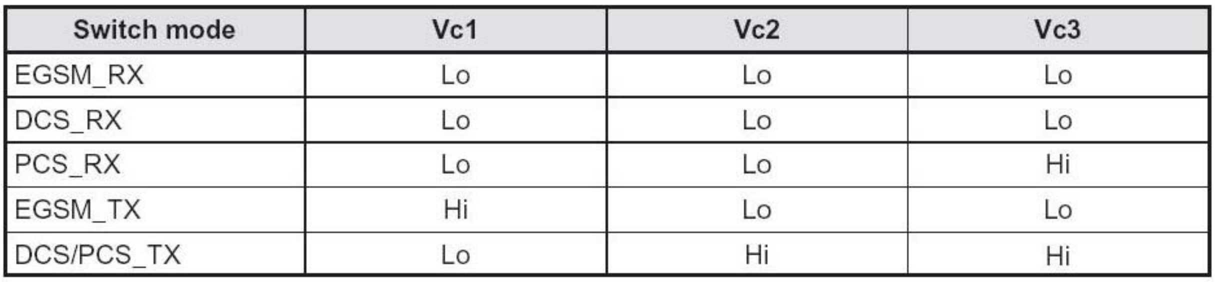
- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above.

3.1.2.3.2.3 Replace Vinku (N7501) or GSM PA (N7502)

3.1.2.3.3 Replace GSM PA (N7502)

3.1.2.4 Are control voltages VC1, VC2 and VC3 coming correctly to the antenna switch (Z7503)?

- Use "RF Controls" window in Phoenix test software to activate the GSM transmitter and to select the wanted GSM band. Procedure is explained in section "Transmitter troubleshooting". GSM RX activation is described in section "GSM RX chain activation for manual measurements".
- Use an oscilloscope and probe to find out if antenna switch control lines are working according to table shown below. "Hi" means that there is 2.4 – 2.8 V control voltage level in the corresponding control line. "Lo" means levels 0 – 0.2 V. Remember to trigger the oscilloscope because control voltages VC1, VC2 and VC3 are pulsed
- Connect the probe to correct test points to measure VC1, VC2 and VC3 voltages (check test point locations, see section "Test point locations). Notice: these test points are PWB pads for three non-assembled capacitors.
- Note! EGSM_RX and EGSM_TX voltages are the same for GSM850.



Switch mode	Vc1	Vc2	Vc3
EGSM_RX	Lo	Lo	Lo
DCS_RX	Lo	Lo	Lo
PCS_RX	Lo	Lo	Hi
EGSM_TX	Hi	Lo	Lo
DCS/PCS_TX	Lo	Hi	Hi

3.1.2.4.1 Replace Hinku (N7500)

3.1.2.5 Replace antenna Switch Z7503

3.1.2.6 Replace antenna switch Z7503

3.1.3 GSM transmitter frequency correct?

- Connect a spectrum analyser to the module test jig's RF connector.

- Set GSM Tx ON. Procedure is explained in section "Transmitter troubleshooting".

- Check if the frequency of the GSM transmitter is as expected. If output signal is not found try to use 500 MHz span setting.

  The correct TX frequency is shown in Phoenix "RF Controls (GSM)" window and can be found also in see section "Frequency mappings". If the frequency is not found at all then go to 3.1.1 "Does GSM TX transmit RF-power at all?"

3.1.3.1 Is TX VCO frequency as expected?

- GSM transmitter has to be active before TX VCO's output frequency and output level can be measured. Procedure is explained in section "Transmitter troubleshooting".

- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings").

- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.

- Connect the RF probe to the T7503 input. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing. *Quick VCO alive check can be done without removing the RF shield. The RF probe should be placed as near the TX VCO output as possible (Put the head of the probe carefully inside the VCO can through the holes of the shield). This method can be used only to check that the TX VCO is alive. It won't expose if the T7503 is broken or the output level of the VCO is too low. Remember to use low RF Attenuator value in the spectrum analyser with this method.*

- Check if the frequency of the TX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -25 dBm during GSM TX burst.

3.1.3.1.1 C7543, C7548 and L7517 ok?

- These components should be checked if TX VCO frequency is not stable and TX PLL frequency not locked.

- Check that components are in place and solder joints are ok

- Disconnect the power supply from the phone and use an ohmmeter to check that inductor is conducting DC.

3.1.3.1.2 TX VCO control voltage VC ok?

- GSM transmitter has to be active before TX VCO control voltage VC can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7519.
- Typical TX VCO control voltage VC should look somehow similar to figure 6.5.3 "TX VC in GSM mode (DC offset 1.8V). DC voltage level should change if TX channel is changed. VC is lower on lower channels and higher if higher channel numbers are used.

3.1.3.1.2.1 VCP2-voltage ok?

- GSM transmitter has to be active before VCP2 voltage can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C2221 (or C7550).
- VCP2 voltage should be about 4.75 V.

3.1.3.1.2.1.1 C7550 and C2221 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to find out if the VCP2-line is short-circuited to the ground. If short-circuit is found replace C7550 and C2221. If this does not help go to the next steps.

3.1.3.1.2.1.2 Retu ok?

3.1.3.1.2.1.3 Vinku (N7501) ok?

3.1.3.1.2.2 Vinku (N7501) RB_EXT voltage ok?

- See section "Vinku (N7501) RB_EXT voltage ok?"

3.1.3.1.2.3 Balun T7503 ok?

- GSM transmitter has to be active before TX VCO's output level can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst

(triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.

- Check the level of the TX VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

3.1.3.1.2.4 Components near TX VCO ok?

C7571, R7519, R7523, C7573 and C7568 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check resistors resistance values with an ohmmeter.
- Use an ohmmeter to check also that capacitors are not short-circuited

3.1.3.1.2.5 Replace Vinku (N7501) or TX VCO (G7502) or both

3.1.3.1.3 Replace TX VCO G7502

3.1.3.2 Is TX VCO signal level in the T7503 output high enough?

- GSM transmitter has to be active before TX VCO’s output level can be measured. Procedure is explained in section “Transmitter troubleshooting”.
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”).
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Check the level of the VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines during GSM TX burst. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

3.1.3.2.1 TX VCO G7502 output level high enough?

- GSM transmitter has to be active before TX VCO’s output frequency and output level can be measured. Procedure is explained in section “Transmitter troubleshooting”.
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”).
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst

(triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.

- Connect the RF probe to the T7503 input. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.
- Check if the frequency of the TX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -25 dBm during GSM TX burst.

3.1.3.2.1.1 Replace TX VCO G7502

3.1.3.2.2 Replace balun T7503

3.1.3.3 VCTCXO frequency and output level ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7529 (or C7582)
- The frequency of the VCTCXO should be quite exactly 38.4 MHz and level about 0.5 - 0.9 Vpp. Example of the correct VCTCXO output signal is presented in figure 4.6.1 "VCTCXO Output (DC Offset 1.24 V)".

3.1.3.3.1 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to C7560 (or C7526, C7513)
- VXO-voltage should be about 2.5 V

3.1.3.3.1.1 C7560, C7513, C7526 and C2214 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to find out if the VXO-line is short-circuited to the ground. If short-circuit is found replace C7560, C7513, C7526 and C2214. If replacing does not help then go to the next steps.

3.1.3.3.1.2 Replace Retu

3.1.3.3.1.3 Replace Hinku (N7500) or Vinku (N7501) or VCTCXO (G7501) or all three components

3.1.3.3.2 BB AFC-voltage ok?

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to R7509 (or C7533)
- AFC-voltage may vary between 0.1 - 2.3 V. Typical value is 1.2 V. Phoenix “RF Controls” tool can be used to change the AFC value. Voltage level should be about 0.1 V with AFC value -1024 and about 2.3 V with AFC value 1023.

3.1.3.3.2.1 Low pass filter components R7509 and C7533 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R7509 resistance value with an ohmmeter.
- Use an ohmmeter to find out also if the AFC-line is short-circuited to the ground. If short-circuit is found replace C7533. If this does not help then go to the next steps.

3.1.3.3.2.2 VCTCXO ok?

- Remove R7509. If AFC-voltage is correct after removing then replace faulty VCTCXO G7501 and solder R7509 (new component) back to the PWB

3.1.3.3.2.3 Replace Retu

3.1.3.3.3 Replace VCTCXO G7501

3.2 Does the phone give realistic RSSI-values?

Attach the phone to the product specific test jig and a signal generator to the RF-coupler. Coupler attenuation should be also taken into account during measurements.

Use the signal generator to supply -90 dBm RF-level (unmodulated signal) to the phone via the antenna coupler. Set generator RF-level to -90 dBm + cable and coupler attenuation. This measurement should be performed in a RF-shielded environment because existing GSM-network base stations can disturb this measurement otherwise.

- Set RF-generator frequency as following:

- GSM850: 881.66771MHz (Channel 190)
- EGSM900: 942.46771 MHz (channel 37)
- GSM1800: 1842.86771 MHz (channel 700)
- GSM1900: 1960.06771 MHz (channel 661)

- Use Phoenix testing & tuning software to perform GSM receiver activation and RSSI measurement for proper channels. Procedure is explained in section “GSM RX chain activation for manual measurements” (Start “Testing” -> “GSM” -> “RSSI Reading” tool in Phoenix. Select the correct band and channel).
- “RSSI Reading” -tool should show quite exact -90 dBm RSSI level. Remember to take into account attenuation between the phone and signal generator. Test also Q and I branches separately. Signal level in both I and Q lines should be about -93 dBm
- Increase signal generator RF level to -60 dBm. Phoenix ”RSSI Reading” tool should show now quite exact RSSI level -60 dBm. Test also Q and I branches separately. Signal level in both I and Q lines should be about -63 dBm

- If RSSI-levels are not as expected separate the phone into parts and place to the module jig. Connect the signal generator to the module jig GSM RF connector (*Notice that there are two antenna connectors in the module jig, one for GSM and one for Bluetooth. Make sure that all connections are made to the correct RF-connector*).

3.2.1 Is Hinku (N7500) ASIC receiving RF-power correctly from the GSM-antenna connector?

- GSM receiver has to be active before measurements. Procedure is explained in section “GSM RX chain activation for manual measurements.”
- Connect an RF-generator to the GSM-antenna connector
- Set RF-generator frequency as following:

- GSM850: 881.66771MHz
- EGSM900: 942.46771 MHz
- GSM1800: 1842.86771 MHz
- GSM1900: 1960.06771 MHz

- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency settings to the spectrum analyser (Centre frequency should be set to the same frequency as the RF-generator). RBW and VBW = 10 kHz, Span = 0 kHz, sweep time 5 ms.
- RF-signals in this measurement are pulsed and video triggering is needed in the spectrum analyser (software dependent issue. With some phone softwares these signals are constant in “Local” mode and triggering is not needed)
- GSM850/EGSM900: Connect the probe to C7512 or C7514. The RF level should be roughly -85 dBm during RX period when input signal in GSM antenna connector is -50 dBm. RF-levels should be about the same on both capacitors. Remember to select the correct band also in Phoenix.
- GSM1800: Connect the probe to C7581 or C7584. The RF level should be roughly -85...-90 dBm during RX period when input signal in GSM antenna connector is -50 dBm. RF-levels should be about the same on both capacitors. Remember to select the correct band also in Phoenix.
- GSM1900: Connect the probe to C7523 or C7525. The RF level should be roughly -85...-90 dBm during RX period when input signal in GSM antenna connector is -50 dBm. RF-levels should be about the same on both capacitors. Remember to select the correct band also in Phoenix.
- **NOTE! If RSSI-values are correct only in one or two GSM-bands but RX ASIC HINKU (N7500) is receiving RF-power correctly from the GSM antenna connector in all three GSM-bands, typically this means that Hinku ASIC (N7500) is faulty or the ASIC is badly soldered. For example: RSSI-values are not realistic in GSM850/EGSM900-band but are ok in other bands and HINKU is receiving RF-power correctly in all bands. Then it’s quite clear that HINKU (N7500) is faulty or badly soldered and the component should be replaced.**

3.2.1.1 Is Z7503 (antenna switch) working correctly?

- GSM receiver has to be active before measurements. Procedure is explained in section "GSM RX chain activation for manual measurements".
- Connect an RF-generator to the GSM-antenna connector
- Set RF-generator frequency as following:

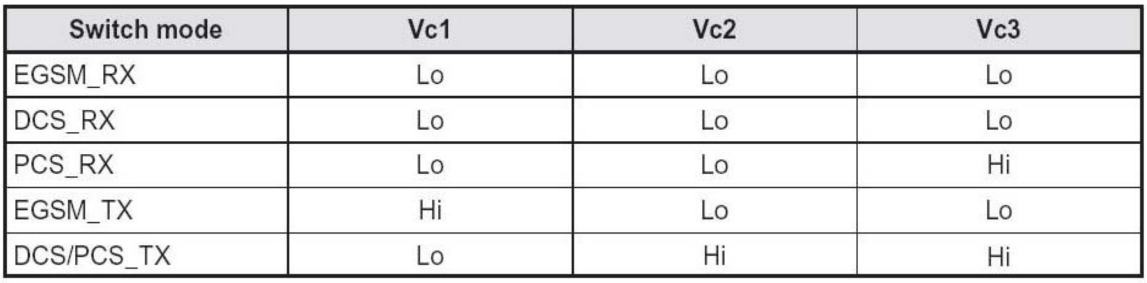
- GSM850: 881.66771MHz (Channel 190)
- EGSM900: 942.46771 MHz (Channel 37)
- GSM1800: 1842.86771 MHz (Channel 700)
- GSM1900: 1960.06771 MHz (Channel 661)

- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency settings to the spectrum analyser (Centre frequency should be set to the same frequency as the RF-generator). RBW and VBW = 10 kHz, Span = 0 kHz, sweep time 5 ms.
- RF-signals in this measurement are pulsed and video triggering is needed in the spectrum analyser (software dependent issue. With some phone softwares these signals are constant in "Local" mode and triggering is not needed).
- GSM850/EGSM900: Connect the probe to L7504. The RF level should be roughly -75 dBm during RX period when input signal in GSM antenna connector is -50 dBm. RF-levels should be about the same on both ends of the inductor. Remember to select the correct band also in Phoenix.
- GSM1800: Connect the probe to L7505. The RF level should be roughly -85 dBm during RX period when input signal in GSM antenna connector is -50 dBm. RF-levels should be about the same on both ends of the inductor. Remember to select the correct band also in Phoenix.
- GSM1900: Connect the probe to L7506. The RF level should be roughly -85 dBm during RX period when input signal in GSM antenna connector is -50 dBm. RF-levels should be about the same on both ends of the inductor. Remember to select the correct band also in Phoenix.

3.2.1.1.1 Are control voltages VC1, VC2 and VC3 coming correctly to the antenna switch (Z7503)?

- Use "RF Controls" window in Phoenix test software to activate the GSM transmitter and to select the wanted GSM band. Procedure is explained in section "Transmitter troubleshooting". GSM RX activation is described in section "GSM RX chain activation for manual measurements".
- Use an oscilloscope and probe to find out if antenna switch control lines are working according to table shown below. "Hi" means that there is 2.4 – 2.8 V control voltage level in the corresponding control line. "Lo" means levels 0 – 0.2 V. Remember to trigger the oscilloscope because control voltages VC1, VC2 and VC3 are pulsed
- Connect the probe to correct test points to measure VC1, VC2 and VC3 voltages (check test point locations, see section "Test point locations"). Notice: these test points are PWB pads for three non-assembled capacitors.

- Note! EGSM_RX and EGSM_TX voltages are the same for GSM850.



Switch mode	Vc1	Vc2	Vc3
EGSM_RX	Lo	Lo	Lo
DCS_RX	Lo	Lo	Lo
PCS_RX	Lo	Lo	Hi
EGSM_TX	Hi	Lo	Lo
DCS/PCS_TX	Lo	Hi	Hi

3.2.1.1.1.1 Replace Hinku (N7500)

3.2.1.1.2 Replace antenna switch Z7503

3.2.1.2 Are matching components in place and working correctly?

GSM850/EGSM900: C7512, C7514 and L7504

GSM1800: C7581, C7584 and L7505

GSM1900: C7523, C7525 and L7506

- Check that components are in place and solder joints are ok
- Use an ohmmeter to check that inductors are conducting DC.
- Replace matching components

3.2.2 Are RX-IQ signal waveforms and levels correct?

- Measurements can be done with an oscilloscope, a probe and signal generator.
- GSM receiver has to be active before RX IQ-signals can be measured. Procedure is explained in section “GSM RX chain activation for manual measurements”.
- Apply –70 dBm RF signal from a signal generator to the module jig antenna connector and use following frequencies:

- EGSM900: 942.46771 MHz (Channel 37)
- GSM1800: 1842.86771 MHz (Channel 700)
- GSM1900: 1960.06771 MHz (Channel 661)

- Remember to change correct RX channels also to Phoenix “RF controls” window!
- Check RX I and RX Q -signals in following test points:

- RX I (positive): Connect the probe to test point J7508
- RX I (negative): Connect the probe to test point J7509
- RX Q (positive): Connect the probe to test point J7510

- RX Q (negative): Connect the probe to test point J7511

- The correct RX IQ-signal is shown in figure 6.5.6 "GSM RX IQ (DC Offset 0.4 V)". Level of all four IQ-signals should be about the same and RX IQ-signal frequency should be 67.71 kHz (lower detail figure). The phase shift between I- and Q-signals should be 90 degrees.

3.2.2.1 RF operating voltage VBAT_ASIC ok?

- See section “RF operating voltage VBAT_ASIC ok?”

3.2.2.2 RFBUS signals ok?

- GSM receiver has to be active before RFBUS signals can be measured. Procedure is explained in section “GSM RX chain activation for manual measurements”. Also WCDMA/GSM transmitter and WCDMA receiver activation can be used for the measurement but then RFBUS -signals don’t necessarily look like in figures mentioned below.

- Measurements can be performed with an oscilloscope and a probe. Check all five RF BUS signals:

- *RFBUSDAT*: Connect the probe to J7504. Typical RFBUSDAT -signal is shown in figures in section 6.5.9.3 “RFBUSDAT (GSM RX)”.

- *RFBUSCLK*: Connect the probe to J7505. Typical RFBUSCLK -signal is shown in section 6.5.9.1 “RFBUSCLK (GSM RX)” and 6.5.9.2 “RFBUSCLK and RFBUSENA (GSM RX)”

- *RFBUSENA*: Connect the probe to J7506. Typical RFBUSENA -signal is shown in section 6.5.9.2 “RFBUSCLK and RFBUSENA (GSM RX)”

- *RXRESETX*: Connect the probe to J7515. RXRESETX -signal is a constant 2 V DC-signal after GSM transceiver has been activated the first time after phone boot up. The level of this signal should be about 0 V before transceiver activation.

- *TXRESETX*: Connect the probe to J7517. TXRESETX -signal is a constant 2 V DC-signal after GSM or WCDMA transceiver has been activated the first time after phone boot up. The level of this signal should be about 0 V before transceiver activation.

3.2.2.2.1 RAP3G (or Vinku or Hinku) faulty?

- RAP3G (D2800) cannot be replaced.

3.2.2.3 Hinku (N7500) regulator voltage VR1 ok?

- GSM receiver has to be active before Hinku’s VR1 voltage can be measured. Procedure is explained in section “GSM RX chain activation for manual measurements”.

- Measurements can be done with an oscilloscope and a probe.

- Connect the probe to C7504 (or C7505)

- VR1 voltage level should be 2.65 – 2.86 V. Typical value is 2.7 V.

3.2.2.3.1 Hinku (N7500) RB_EXT voltage ok?

- GSM receiver has to be active before Hinku's RB_EXT voltage can be measured. Procedure is explained in section "GSM RX chain activation for manual measurements".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7504.
- RB_EXT voltage should be 1.325 – 1.375 V.

3.2.2.3.1.1 VREFRF01-voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7503.
- VREFRF01 voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

3.2.2.3.1.1.1 Desolder R7503. Is VREFRF01 voltage still wrong?

Remember to solder a new component to R7503 pads after measurement.

3.2.2.3.1.1.1.1 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.2.2.3.1.1.1.2 Replace Vinku (N7501) or Hinku (N7500) or both

3.2.2.3.1.1.2 Retu ok?

3.2.2.3.1.2 R7521 and R7504 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R521 and R504 resistance values with an ohmmeter.

3.2.2.3.1.3 VB_EXT voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7518.
- VB_EXT voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

3.2.2.3.1.3.1 R7503 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7503 resistance value with an ohmmeter

3.2.2.3.1.3.2 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.2.2.3.1.3.3 Replace Hinku (N7500) or Vinku (N7501) or both

3.2.2.3.1.4 Replace Hinku (N7500)

3.2.2.3.2 Are capacitors in Hinku (N7500) regulator lines working correctly?

C7504, C7515, C7509, C7508, C7596, C7598 and C7505

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.2.2.3.3 RX VCO G7500 ok?

3.2.2.3.4 Replace Hinku (N7500)

3.2.2.4 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to C7560 (or C7526, C7513)
- VXO-voltage should be about 2.5 V

3.2.2.4.1 C7560, C7513, C7526 and C2214 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to find out if the VXO-line is short-circuited to the ground. If short-circuit is found replace C7560, C7513, C7526 and C2214. If replacing does not help then go to the next steps.

3.2.2.4.2 Replace Retu

3.2.2.4.3 Replace Hinku (N7500) or Vinku (N7501) or VCTCXO (G7501) or all three components

3.2.2.5 VCP1-voltage ok?

- GSM receiver has to be active before VCP1 voltage can be measured. Procedure is explained in section "GSM RX chain activation for manual measurements".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7507.
- VCP1 voltage should be about 4.75 V.

3.2.2.5.1 C7507 and C2222 working properly?

- Check that the components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that C507 and C2222 are not short-circuited.

3.2.2.5.2 Retu ok?

3.2.2.5.3 Hinku (N7500) ok?

3.2.2.6 VCTCXO frequency and output level correct?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7529 (or C7582)
- The frequency of the VCTCXO should be quite exactly 38.4 MHz and level about 0.5 - 0.9 Vpp. Example of the correct VCTCXO output signal is presented in figure 4.6.1 "VCTCXO Output (DC Offset 1.24 V)".

3.2.2.6.1 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to C7560 (or C7526, C7513)
- VXO-voltage should be about 2.5 V

3.2.2.6.1.1 C7560, C7513, C7526 and C2214 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to find out if the VXO-line is short-circuited to the ground. If short-circuit is found replace C7560, C7513, C7526 and C2214. If replacing does not help then go to the next steps.

3.2.2.6.1.2 Replace Retu

3.2.2.6.1.3 Replace Hinku (N7500) or Vinku (N7501) or VCTCXO (G7501) or all three components

3.2.2.6.2 BB AFC-voltage ok?

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to R7509 (or C7533)
- AFC-voltage may vary between 0.1 - 2.3 V. Typical value is 1.2 V. Phoenix “RF Controls” tool can be used to change the AFC value. Voltage level should be about 0.1 V with AFC value -1024 and about 2.3 V with AFC value 1023.

3.2.2.6.2.1 Low pass filter components R7509 and C7533 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R7509 resistance value with an ohmmeter.
- Use an ohmmeter to find out also if the AFC-line is short-circuited to the ground. If short-circuit is found replace C7533. If this does not help then go to the next steps.

3.2.2.6.2.2 VCTCXO ok?

- Remove R7509. If AFC-voltage is correct after removing then replace faulty VCTCXO G7501 and solder R7509 (new component) back to the PWB

3.2.2.6.2.3 Replace Retu

3.2.2.6.3 Replace VCTCXO G7501

3.2.2.7 Is there RF power in the RX VCO output at all?

- GSM receiver has to be active before RX VCO’s output frequency and output level can be measured. Procedure is explained in section “GSM RX chain activation for manual measurements”.
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see section “Frequency mappings”).
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during RX is active (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Connect the RF probe to the T7501 input.
- Check if the frequency of the RX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -20...-30 dBm.

3.2.2.7.1 RX VCO operating voltage VR1 RX ok?

- GSM receiver has to be active before Hinku's VR1 voltage can be measured. Procedure is explained in GSM RX chain activation for manual measurements.
- Measurements can be done with an oscilloscope and a probe.
- Connect the probe to C7504 (or C7505) VR1 voltage level should be 2.65 – 2.86 V. Typical value is 2.7 V.

3.2.2.7.1.1 Hinku (N7500) regulator voltage VR1 ok?

- See section "Hinku (N7500) regulator voltage VR1 ok?"

3.2.2.7.1.2 Replace Hinku (N7500)

3.2.2.7.2 Replace RX VCO (G7500)

3.2.2.8 Is RX VCO RF-signal coming to the Hinku at all?

- GSM receiver has to be active before RX VCO's output frequency and output level can be measured. Procedure is explained in section "GSM RX chain activation for manual measurements".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see section "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during RX is active (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Check the level of the VCO frequency in T7501 outputs. The level should be about -25...-35 dBm in both output lines. If the signal level is correct in the input (about -20...-30 dBm) but output level is not as expected then replace T7501.

3.2.2.8.1 Replace balun T7501

3.2.2.9 Is RX VCO frequency as expected?

- GSM receiver has to be active before RX VCO's output frequency and output level can be measured. Procedure is explained in section "GSM RX chain activation for manual measurements".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see section "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during RX is

active (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.

- Connect the RF probe to the T7501 input.
- Check if the frequency of the RX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -20...-30 dBm.

3.2.2.9.1 RX VCO control voltage VC ok?

- GSM receiver has to be active before RX VCO control voltage VC can be measured. Procedure is explained in section “GSM RX chain activation for manual measurements”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7501.
- Typical RX VCO control voltage VC should look somehow similar to figure 6.5.7 (GSM mode). VC voltage should be between 0.7 - 3.8 V. DC voltage level should change if RX channel is changed. VC is lower on lower channels and higher if higher channel numbers are used.

3.2.2.9.1.1 VCP1-voltage ok?

- GSM receiver has to be active before VCP1 voltage can be measured. Procedure is explained in section “GSM RX chain activation for manual measurements”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7507.
- VCP1 voltage should be about 4.75 V.

3.2.2.9.1.1.1 C7507 and C2222 working properly?

- Check that the components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that C507 and C2222 are not short-circuited.

3.2.2.9.1.1.2 Retu ok?

3.2.2.9.1.1.3 Hinku (N7500) ok?

3.2.2.9.1.2 Hinku (N7500) RB_EXT voltage ok?

- GSM receiver has to be active before Hinku’s RB_EXT voltage can be measured. Procedure is explained in section “GSM RX chain activation for manual measurements”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7504.
- RB_EXT voltage should be 1.325 – 1.375 V.

3.2.2.9.1.2.1 VREFRF01-voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7503.
- VREFRF01 voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

3.2.2.9.1.2.1.1 Desolder R7503. Is VREFRF01 voltage still wrong?

Remember to solder a new component to R7503 pads after measurement.

3.2.2.9.1.2.1.1.1 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.2.2.9.1.2.1.1.2 Replace Vinku (N7501) or Hinku (N7500) or both

3.2.2.9.1.2.1.2 Retu ok?

3.2.2.9.1.2.2 R7521 and R7504 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R521 and R504 resistance values with an ohmmeter.

3.2.2.9.1.2.3 VB_EXT voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7518.
- VB_EXT voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

3.2.2.9.1.2.3.1 R7503 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7503 resistance value with an ohmmeter

3.2.2.9.1.2.3.2 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok

- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.2.2.9.1.2.3.3 Replace Hinku (N7500) or Vinku (N7501) or both

3.2.2.9.1.2.4 Replace Hinku (N7500)

3.2.2.9.1.3 Balun T7501 ok?

- GSM receiver has to be active before RX VCO's output frequency and output level can be measured. Procedure is explained in section "GSM RX chain activation for manual measurements".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see section "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during RX is active (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Check the level of the VCO frequency in T7501 outputs. The level should be about -25...-35 dBm in both output lines. If the signal level is correct in the input (about -20...-30 dBm) but output level is not as expected then replace T7501.

3.2.2.9.1.4 Are components near the RX VCO ok?

R7501, C7516, R7505, C7524 and C7522 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check resistors resistance values with an ohmmeter.
- Use an ohmmeter to check also that capacitors are not short-circuited

3.2.2.9.1.5 Replace Hinku (N7500) or RX VCO (G7500) or both

3.2.2.9.2 Replace RX VCO G7500

3.2.2.10 Is RX VCO signal level in the T7501 output high enough?

- GSM receiver has to be active before RX VCO's output frequency and output level can be measured. Procedure is explained in section "GSM RX chain activation for manual measurements".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see section "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during RX is

active (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.

- Check the level of the VCO frequency in T7501 outputs. The level should be about -25...-35 dBm in both output lines. If the signal level is correct in the input (about -20...-30 dBm) but output level is not as expected then replace T7501.

3.2.2.10.1 RX VCO G7500 output level high enough?

- GSM receiver has to be active before RX VCO's output frequency and output level can be measured. Procedure is explained in section "GSM RX chain activation for manual measurements".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see section "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during RX is active (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Connect the RF probe to the T7501 input.
- Check if the frequency of the RX VCO is as expected. If the VCO signal is not found try to use wider span setting. Output level of the VCO should be about -20...-30 dBm.

3.2.2.10.1.1 Replace RX VCO G7500

3.2.2.10.2 Replace balun T7501

3.2.2.11 VCTCXO frequency and output level correct?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7529 (or C7582)
- The frequency of the VCTCXO should be quite exactly 38.4 MHz and level about 0.5 - 0.9 Vpp. Example of the correct VCTCXO output signal is presented in figure 4.6.1 "VCTCXO Output (DC Offset 1.24 V)".

3.2.2.11.1 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to C7560 (or C7526, C7513)
- VXO-voltage should be about 2.5 V

3.2.2.11.1.1 C7560, C7513, C7526 and C2214 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to find out if the VXO-line is short-circuited to the ground. If short-circuit is found replace C7560, C7513, C7526 and C2214. If replacing does not help then go to the next steps.

3.2.2.11.1.2 Replace Retu

3.2.2.11.1.3 Replace Hinku (N7500) or Vinku (N7501) or VCTCXO (G7501) or all three components

3.2.2.11.2 BB AFC-voltage ok?

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to R7509 (or C7533)
- AFC-voltage may vary between 0.1 - 2.3 V. Typical value is 1.2 V. Phoenix “RF Controls” tool can be used to change the AFC value. Voltage level should be about 0.1 V with AFC value -1024 and about 2.3 V with AFC value 1023.

3.2.2.11.2.1 Low pass filter components R7509 and C7533 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R7509 resistance value with an ohmmeter.
- Use an ohmmeter to find out also if the AFC-line is short-circuited to the ground. If short-circuit is found replace C7533. If this does not help then go to the next steps.

3.2.2.11.2.2 VCTCXO ok?

- Remove R7509. If AFC-voltage is correct after removing then replace faulty VCTCXO G7501 and solder R7509 (new component) back to the PWB

3.2.2.11.2.3 Replace Retu

3.2.2.11.3 Replace VCTCXO G7501

3.2.2.12 Replace Hinku ASIC (N7500)

3.2.3 Is RAP3G ASIC getting ok VREFCM-signal from Hinku (N7500)? Signal level ok?

- GSM receiver has to be active before VREFCM signal can be measured. Procedure is explained in section “GSM RX chain activation for manual measurements”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to J7516.
- VREFCM voltage should be about 780 mV (continuous voltage).

3.2.3.1 Hinku (N7500) RB_EXT voltage ok?

- GSM receiver has to be active before Hinku's RB_EXT voltage can be measured. Procedure is explained in section "GSM RX chain activation for manual measurements".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7504.
- RB_EXT voltage should be 1.325 – 1.375 V.

3.2.3.1.1 VREFRF01-voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7503.
- VREFRF01 voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

3.2.3.1.1.1 Desolder R7503. Is VREFRF01 voltage still wrong?

Remember to solder a new component to R7503 pads after measurement.

3.2.3.1.1.1.1 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.2.3.1.1.1.2 Replace Vinku (N7501) or Hinku (N7500) or both

3.2.3.1.1.2 Retu ok?

3.2.3.1.2 R7521 and R7504 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R521 and R504 resistance values with an ohmmeter.

3.2.3.1.3 VB_EXT voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7518.
- VB_EXT voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

3.2.3.1.3.1 R7503 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7503 resistance value with an ohmmeter

3.2.3.1.3.2 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.2.3.1.3.3 Replace Hinku (N7500) or Vinku (N7501) or both

3.2.3.1.4 Replace Hinku (N7500)

3.2.3.2 Replace Hinku (N7500)

- Also RAP3G can be faulty but it’s not possible to replace this component

3.2.4 RAP3G faulty?

- Not possible to replace!

3.3 GSM Transmitter phase error ok?

- GSM transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”. Change TX data type to “Random” in Phoenix.
- Measurement can be done with a GSM transmitter tester or other GSM communication tester. Trigger to TX burst midamble should be used.
- Attach the phone to the product specific test jig and the RF-measurement device to the RF-coupler. Coupler attenuation should be also taken into account during measurements.
- The RMS Phase error shall not be greater than 5° and the peak phase error not greater than 20°.
- If phase error is not as expected separate the phone into parts and place to the module jig

3.3.1 Are capacitors in Vinku REG1 and REG2 lines in place?

C7554, C7555 and C7547 (GSM1800 and GSM1900: also C7552)

- Check that components are in place and solder joints are ok

3.3.2 Are capacitors in GSM PA power supply line in place?

- C7569 and C7583
- Check that component is in place and solder joints are ok

3.3.3 Are TX-IQ signals ok?

- These current mode signals are not possible to measure, but are tested with self-tests. So if there is no fail in 2.3 "ST_CDSP_TX_IQ_TEST" these signals should be ok. Otherwise Vinku (N7501) or RAP3G (D2800) is faulty. Notice that it is not possible to replace RAP3G ASIC.

3.3.4 Is TX VCO signal level in the T7503 output high enough?

- GSM transmitter has to be active before TX VCO's output level can be measured. Procedure is explained in section "Transmitter troubleshooting".

- Measurements can be done with a spectrum analyser and an RF probe. RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings"). Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.

- Check the level of the VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines during GSM TX burst. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

3.3.4.1 TX VCO G7502 output level high enough?

- GSM transmitter has to be active before TX VCO's output frequency and output level can be measured. Procedure is explained in section "Transmitter troubleshooting".

- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings").

- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.

- Connect the RF probe to the T7503 input. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

- Check if the frequency of the TX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -25 dBm during GSM TX burst.

3.3.4.1.1 Replace TX VCO G7502

3.3.4.2 Replace balun T7503

3.3.5 VCTCXO frequency and output level correct?

- Measurement can be done with an oscilloscope and a probe.

- Connect the probe to C7529 (or C7582)
- The frequency of the VCTCXO should be quite exactly 38.4 MHz and level about 0.5 - 0.9 Vpp. Example of the correct VCTCXO output signal is presented in figure 4.6.1 "VCTCXO Output (DC Offset 1.24 V)".

3.3.5.1 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to C7560 (or C7526, C7513)
- VXO-voltage should be about 2.5 V

3.3.5.1.1 C7560, C7513, C7526 and C2214 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to find out if the VXO-line is short-circuited to the ground. If short-circuit is found replace C7560, C7513, C7526 and C2214. If replacing does not help then go to the next steps.

3.3.5.1.2 Replace Retu

3.3.5.1.3 Replace Hinku (N7500) or Vinku (N7501) or VCTCXO (G7501) or all three components

3.3.5.2 BB AFC-voltage ok?

- See section "BB AFC-voltage ok?"

3.3.5.3 Replace VCTCXO G7501

3.4 GSM (GMSK) modulation spectrum ok?

- GSM transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”.
- Measurement can be done with a GSM transmitter tester or other GSM communication tester. Settings have to be done according to the 3GPP specifications. Modulation spectrum measurement is possible to perform also with a spectrum analyser, but in this case measurement settings have to be done manually.
- Attach the phone to the product specific test jig and the RF-test device to the RF-coupler. Coupler attenuation should be also taken into account during measurements.

- Set TX Data Type to “Random” in Phoenix
- Enter correct “Centre frequency” to the spectrum analyser (see section “Frequency mappings”) and “Span” should be set to 2 MHz. “RBW” and “VBW” should be set to 30 kHz.
- Select a correct attenuator in the spectrum analyser and set “reference level offset” according attenuation between the phone and the spectrum analyser.
- Enter “Sweep time” at least to 2.5 s.

- Check that the TX power is not over the specification limits in following offsets (tables below). If the measurement is performed with a spectrum analyser according above settings then there may be 1 to 3 dB exceeding with some limit values. This is caused because above settings are meant only for fast modulation spectrum checking and are not exactly done according 3GPP specification.

GSM850/EGSM900/GSM1800:

Offset (kHz)	100	200	250	400	≥ 600 < 1 800
Limit (dBc)	+0,5	-30	-33	-60	-60

GSM1900:

Offset (kHz)	100	200	250	400	≥ 600 < 1 200	≥ 1 200 < 1 800
Limit (dBc)	+0,5	-30	-33	-60	-60	-60

One example of measured GSM Modulation Spectrum in GSM850/EGSM900 band is presented in figure 6.5.8 "TX Modulation spectrum (GSM)"..

- If modulation spectrum is not as expected separate the phone into parts and place to the module jig.

3.4.1 Are components in GSM power control loop in place and working ok?

R7516 and C7559

- Disconnect the power supply from the phone and use an ohmmeter to check that C7559 is not short-circuited. If short-circuit is found replace the capacitor. Check R7516 resistance value with an ohmmeter and replace resistor if needed.

3.4.2 Does GSM PA (N7502) get correct bias currents? Is the level of bias currents ok?

EGSM: Icont_21 and Icont_22
GSM1800/GSM1900: Icont_31 and Icont_32

- GSM transmitter has to be active before measurements. Procedure is explained in section "Transmitter troubleshooting".
- Set TX power level to the maximum ("5" in GSM850/EGSM900 and "0" in GSM1800/GSM1900)
- Measurements can be done with an oscilloscope and a VOLTAGE probe.
- GSM850/EGSM900:

- Connect the probe to C7545 or C7544. Notice: C7544 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB
- Typical full TX power bias currents (Icont_21 and Icont_22) should look somehow similar to figure 4.6.4 when measured with an oscilloscope and a probe. Check both currents.

- GSM1800 or GSM1900:

- Connect the probe to C7561 or C7556. Notice: C7556 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB

Typical full TX power bias currents (Icont_31 and Icont_32) should look somehow similar to figure 6.5.5 "Icont_31/Icont_32 (DC Offset 1.2 V)" when measured with an oscilloscope and a probe. Check both currents.

3.4.2.1 Vinku (N7501) RB_EXT voltage ok?

- See section "Vinku (N7501) RB_EXT voltage ok?"

3.4.2.2 Are capacitors in GSM PA (N7502) bias lines working correctly?

EGSM: Icont_21 missing – Replace Vinku
Icont_22 missing – C7545 short-circuited?
GSM1800/GSM1900: Icont_31 missing – C7556 short-circuited?
Icont_32 missing – C7561 short-circuited?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.4.2.3 Replace Vinku (N7501)

3.4.3 Are TX-IQ signals ok?

- These current mode signals are not possible to measure, but are tested with self-tests. So if there is no fail in 2.3 "ST_CDSP_TX_IQ_TEST" these signals should be ok. Otherwise Vinku (N7501) or RAP3G (D2800) is faulty. Notice that it is not possible to replace RAP3G ASIC.

3.4.4 Is TX VCO signal level in the T7503 output high enough?

- GSM transmitter has to be active before TX VCO's output level can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings"). Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Check the level of the VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines during GSM TX burst. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

3.4.4.1 TX VCO G7502 output level high enough?

- GSM transmitter has to be active before TX VCO's output frequency and output level can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Connect the RF probe to the T7503 input. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.
- Check if the frequency of the TX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -25 dBm during GSM TX burst.

3.4.4.1.1 Replace TX VCO G7502

3.4.4.2 Replace balun T7503

3.4.5 Replace Vinku (N7501) or GSM PA (N7502) or both

3.5 TX power vs. time ok?

This section means situation when GSM TX power levels are ok, but burst timing is not correct or power changes during TX burst.

- GSM transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”. ***Note!*** *It is probably needed to change the Tx Data Type in Phoenix to “Random” before this measurement can be performed.*
- Measurement can be done with a GSM transmitter tester or other GSM communication tester. Attach the phone to the product specific test jig and the measurement device to the RF-coupler. Coupler attenuation should be also taken into account during measurements.
- If TX power vs. time is not as expected separate the phone into parts and place to the module jig.

3.5.1 Is the TXC-signal coming to Vinku ASIC (N7501) OK?

- GSM transmitter has to be active before TX control voltage TXC can be measured. Procedure is explained in section “Transmitter troubleshooting”.
- Set TX power level first to the maximum (“5” in GSM850/EGSM900 and “0” in GSM1800/GSM1900)
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7549
- Typical TX control voltage TXC timing should look somehow similar to figure 4.6.2 "TXC in GSM mode (DC Offset 0 V)" (GSM850/EGSM900 TX power level 5) and voltage levels should be roughly:

- GSM850/EGSM900: 1.8 V while TX burst and 0 V otherwise.
- GSM1800/GSM1900: 1.8 V while TX burst and 0 V otherwise.

- Change the TX to the minimum power level (“19” in EGSM and “15” in GSM1800/GSM1900)
- Typical TX control voltage TXC levels should be now about:

- GSM850/EGSM900: 1.0 V while TX burst and 0 V otherwise.

- GSM1800/GSM1900: 0.7 V while TX burst and 0 V otherwise.

3.5.1.1 R7514 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R514 resistance value with an ohmmeter

3.5.1.2 C7549 working correctly?

- Check that the component is in place and solder joints are ok

- Disconnect the power supply from the phone and check with an ohmmeter that C7549 is not short-circuited.

3.5.1.3 Retu ok?

3.5.2 Does GSM PA (N7502) get correct bias currents? Is the level of bias currents ok?

EGSM: Icont_21 and Icont_22
GSM1800/GSM1900: Icont_31 and Icont_32

- GSM transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”.
- Set TX power level to the maximum (“5” in GSM850/EGSM900 and “0” in GSM1800/GSM1900)
- Measurements can be done with an oscilloscope and a VOLTAGE probe.
- GSM850/EGSM900:

- Connect the probe to C7545 or C7544. Notice: C7544 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB

- Typical full TX power bias currents (Icont_21 and Icont_22) should look somehow similar to figure 4.6.4 when measured with an oscilloscope and a probe. Check both currents.

- GSM1800 or GSM1900:

- Connect the probe to C7561 or C7556. Notice: C7556 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB

- Typical full TX power bias currents (Icont_31 and Icont_32) should look somehow similar to figure 6.5.5 "Icont_31/Icont_32 (DC Offset 1.2 V)" when measured with an oscilloscope and a probe. Check both currents.

3.5.2.1 Vinku (N7501) RB_EXT voltage ok?

- See section "Vinku (N7501) RB_EXT voltage ok?"

3.5.2.2 Are capacitors in GSM PA (N7502) bias lines working correctly?

EGSM: Icont_21 missing – Replace Vinku
Icont_22 missing – C7545 short-circuited?
GSM1800/GSM1900: Icont_31 missing – C7556 short-circuited?
Icont_32 missing – C7561 short-circuited?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.5.2.3 Replace Vinku (N7501)

3.5.3 Does GSM PA (N7502) get correct DET_SW_G -voltage from Vinku ASIC (N7501)?

- GSM transmitter has to be active before DET_SW_G voltage can be measured. Procedure is explained in section “Transmitter troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7595. Notice: C7595 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB.
- DET_SW_G voltage should be about 2.8 V while TX burst and 0 V otherwise.

3.5.3.1 Replace Vinku (N7501)

3.5.4 Are components in GSM power control loop in place and working ok?

R7516 and C7559

- Disconnect the power supply from the phone and use an ohmmeter to check that C7559 is not short-circuited. If short-circuit is found replace the capacitor.
- Check R7516 resistance value with an ohmmeter and replace resistor if needed.

4. DOES THE PHONE HAVE A RELIABLE CONNECTION TO THE NETWORK (GSM)?

This section refers to a situation when the phone registers to the GSM-network and is capable to make a call, but the call is not reliable even if the GSM-network field strength is strong. The phone call is maybe disconnected or interrupted.

4.1 GSM receiver Bit Error Rate (BER) ok?

- This test needs a GSM communication tester and if there is no that kind of tester available continue troubleshooting in section 3.2 "Does the phone give realistic RSSI-values?".
- Attach the phone to the product specific test jig and a GSM communication tester to the RF-coupler. Coupler attenuation should be also taken into account during measurements. This measurement should be done in an RF shielded box.
- Close the shield box hatch.
- Make a GSM call against the tester
- Settings to the tester have to be done according to the 3GPP specifications:
- Set base station downlink power to -102 dBm
- Bit Error Rate should be less than 2 %

4.1.1 Does the phone give realistic RSSI-values?

- See section 3.2. "Does the phone give realistic RSSI-values?"

4.1.2 Hinku (N7500) or RAP3G (D2800) faulty?

- RAP3G is not possible to replace

4.2 GSM transmitter power levels and transmit frequency ok?

- See section 3.1. "GSM transmitter power levels and transmit frequency ok?"

4.3 GSM Transmitter phase error ok?

- See section 3.3. "GSM Transmitter phase error ok?"

4.4 GSM (GMSK) modulation spectrum ok?

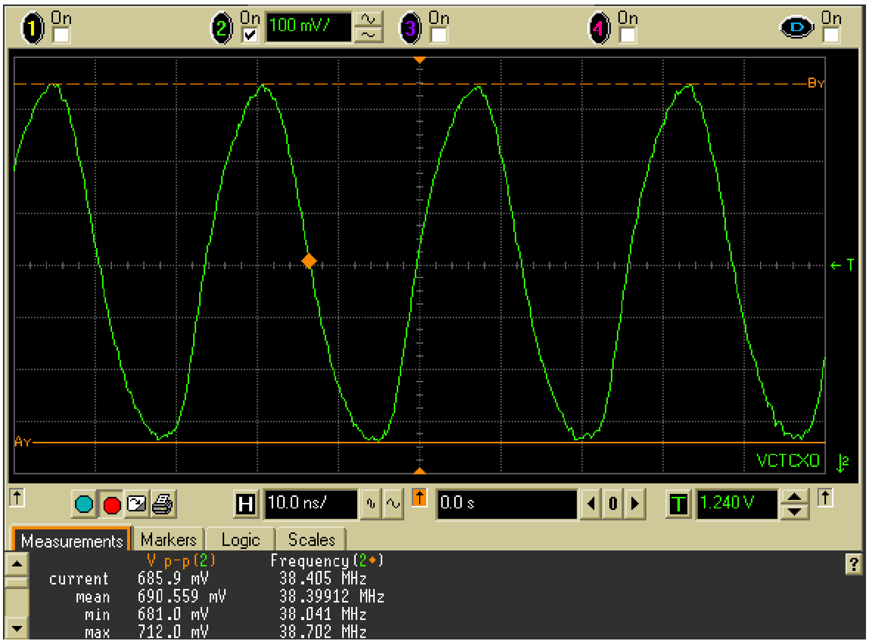
- See section 3.4. "GSM (GMSK) modulation spectrum ok?"

4.5 TX power vs. time ok?

- See section 3.5. "TX power vs. time ok?"

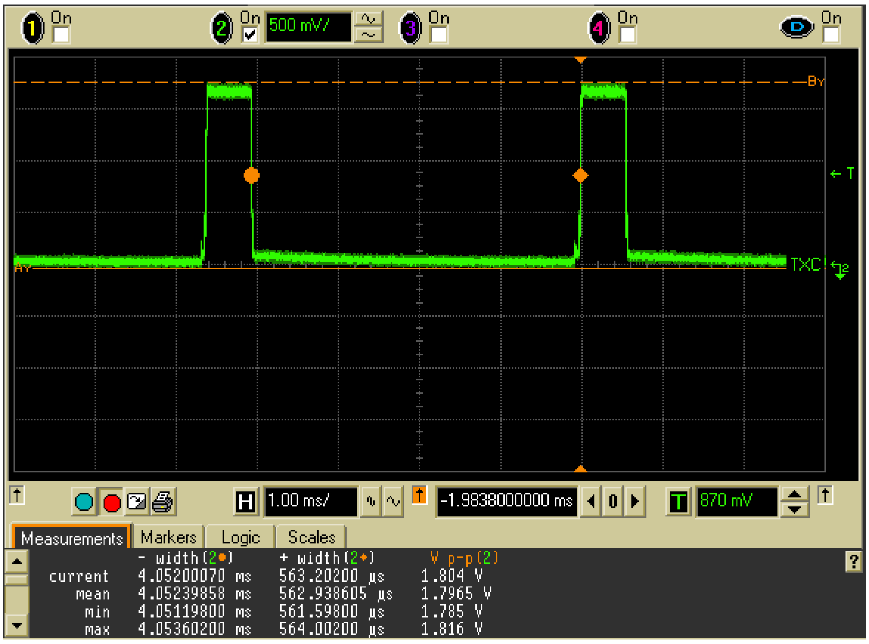
4.6 Troubleshooting pictures

4.6.1 VCTCXO Output (DC Offset 1.24 V)


1 On
2 On
100 mV/
3 On
4 On
On
BY
AY
T
VCTCXO
H
10.0 ns/
0.0 s
0
T
1.240 V
Measurements
Markers
Logic
Scales
?

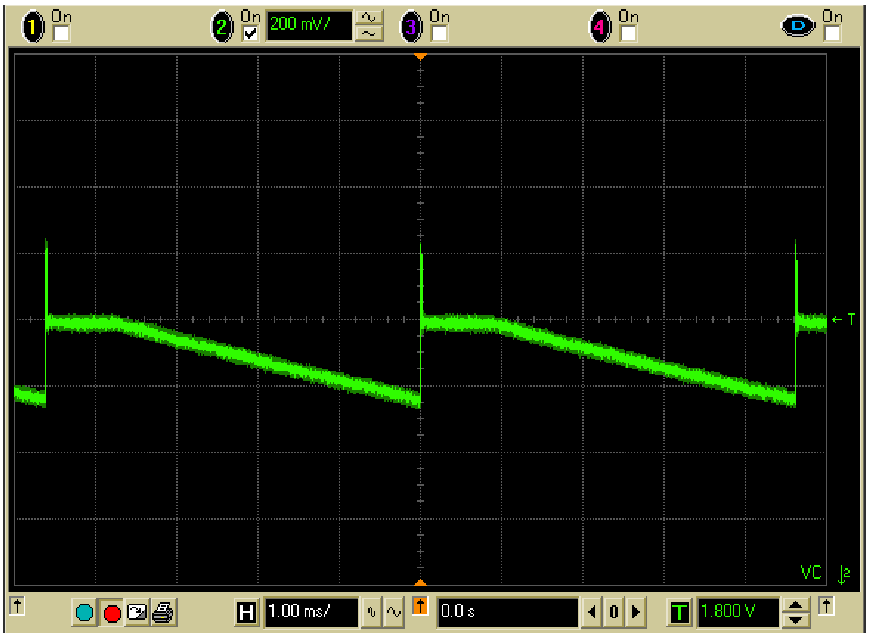
```
           V p-p(2)        Frequency(2+)
current    685.9 mV         38.405 MHz
   mean    690.559 mV       38.39912 MHz
    min    681.0 mV         38.041 MHz
    max    712.0 mV         38.702 MHz
```

4.6.2 TXC in GSM mode (DC Offset 0 V)


1 On
2 On
500 mV/
3 On
4 On
On
BY
AY
T
TXC
H
1.00 ms/
-1.9838000000 ms
0
T
870 mV
Measurements
Markers
Logic
Scales
?

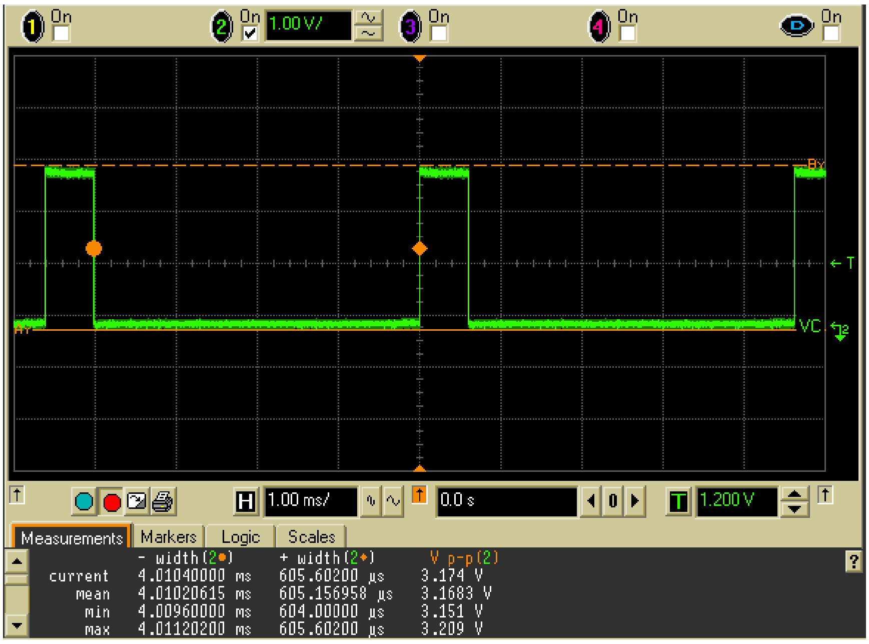
```
           - width(2●)       + width(2+)        V p-p(2)
current    4.05200070 ms     563.20200 µs       1.804 V
   mean    4.05239858 ms     562.938605 µs      1.7965 V
    min    4.05119800 ms     561.59800 µs       1.785 V
    max    4.05360200 ms     564.00200 µs       1.816 V
```

4.6.3 TX VC in GSM mode (DC Offset 1.8 V)


1 On
2 On
200 mV/
3 On
4 On
On
T
VC
2
H
1.00 ms/
0.0 s
0
T
1.800 V

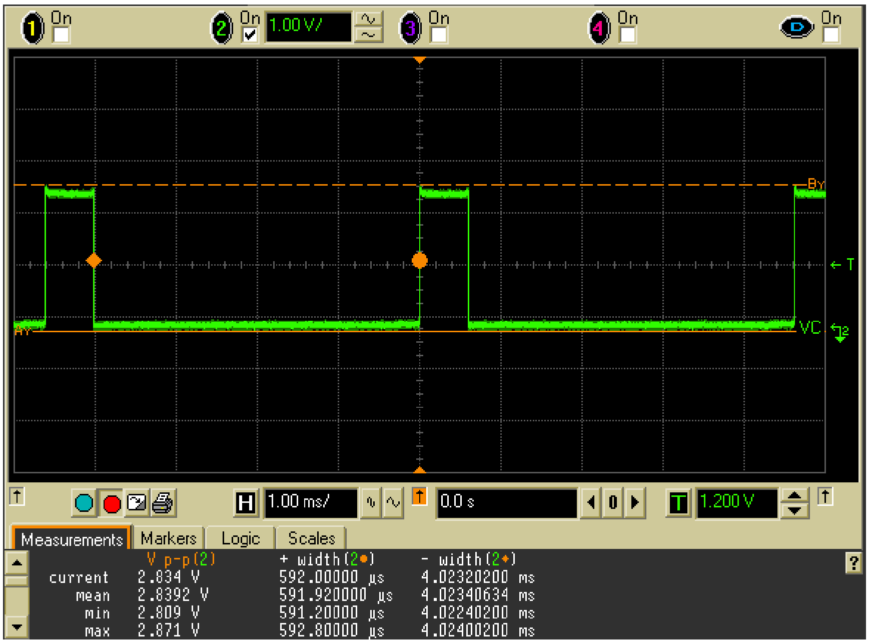
DC value changes if channel or band is changed. Upper figure has been taken in GSM850/EGSM900 band and on channel 37.

4.6.4 Icont_21/Icont_22 (DC Offset 1.2 V)


1 On
2 On
1.00 V/
3 On
4 On
On
BY
AY
T
VC
2
H
1.00 ms/
0.0 s
0
T
1.200 V
Measurements
Markers
Logic
Scales
?

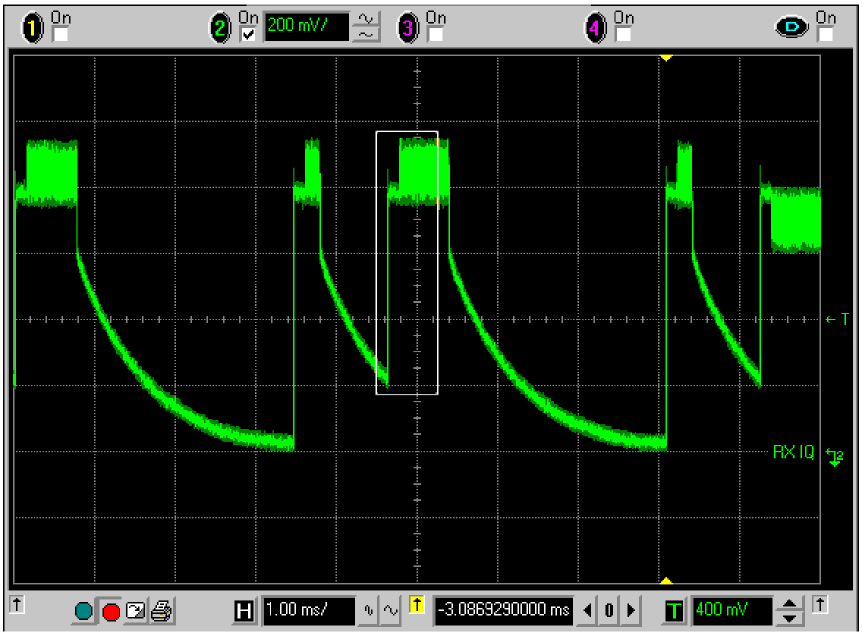
```
          - width(2●)        + width(2◆)       V p-p(2)
current   4.01040000 ms     605.60200  µs     3.174  V
   mean   4.01020615 ms     605.156958  µs    3.1683 V
    min   4.00960000 ms     604.00000  µs     3.151  V
    max   4.01120200 ms     605.60200  µs     3.209  V
```

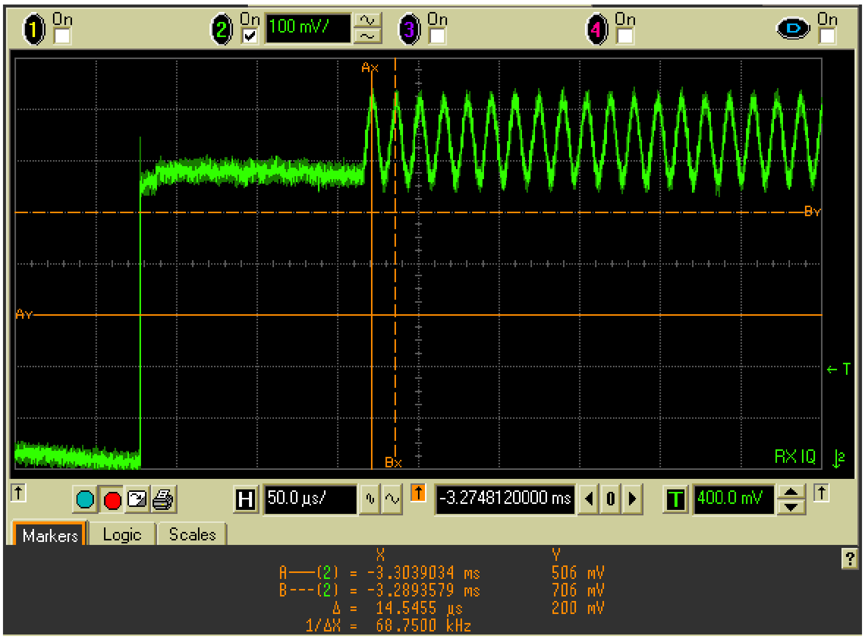
4.6.5 Icont_31/Icont_32 (DC Offset 1.2 V)


1 On
2 On
1.00 V/
3 On
4 On
On
BY
T
VC
AY
H
1.00 ms/
0.0 s
0
T
1.200 V
Measurements
Markers
Logic
Scales
?

```
           V p-p(2)        + width(2•)       - width(2•)
 current   2.834 V         592.00000 µs      4.02320200 ms
    mean   2.8392 V        591.920000 µs     4.02340634 ms
     min   2.809 V         591.20000 µs      4.02240200 ms
     max   2.871 V         592.80000 µs      4.02400200 ms
```

4.6.6 GSM RX IQ (DC Offset 0.4 V)

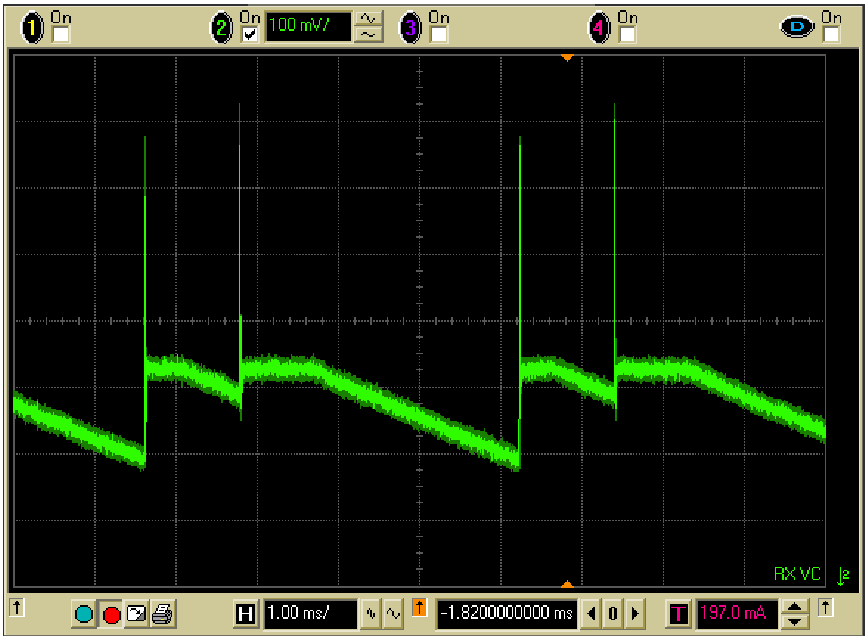

1 On
2 On ☑ 200 mV/
3 On
4 On
On
T
RX IQ
H 1.00 ms/
-3.0869290000 ms
0
T 400 mV


1 On
2 On ☑ 100 mV/
3 On
4 On
On
Ax
Bx
Ay
By
T
RX IQ
H 50.0 µs/
-3.2748120000 ms
0
T 400.0 mV
Markers
Logic
Scales
?

```
                  X                     Y
A——(2) = -3.3039034 ms           506  mV
B---(2) = -3.2893579 ms           706  mV
      Δ =  14.5455 µs            200  mV
   1/ΔX =  68.7500 kHz
```

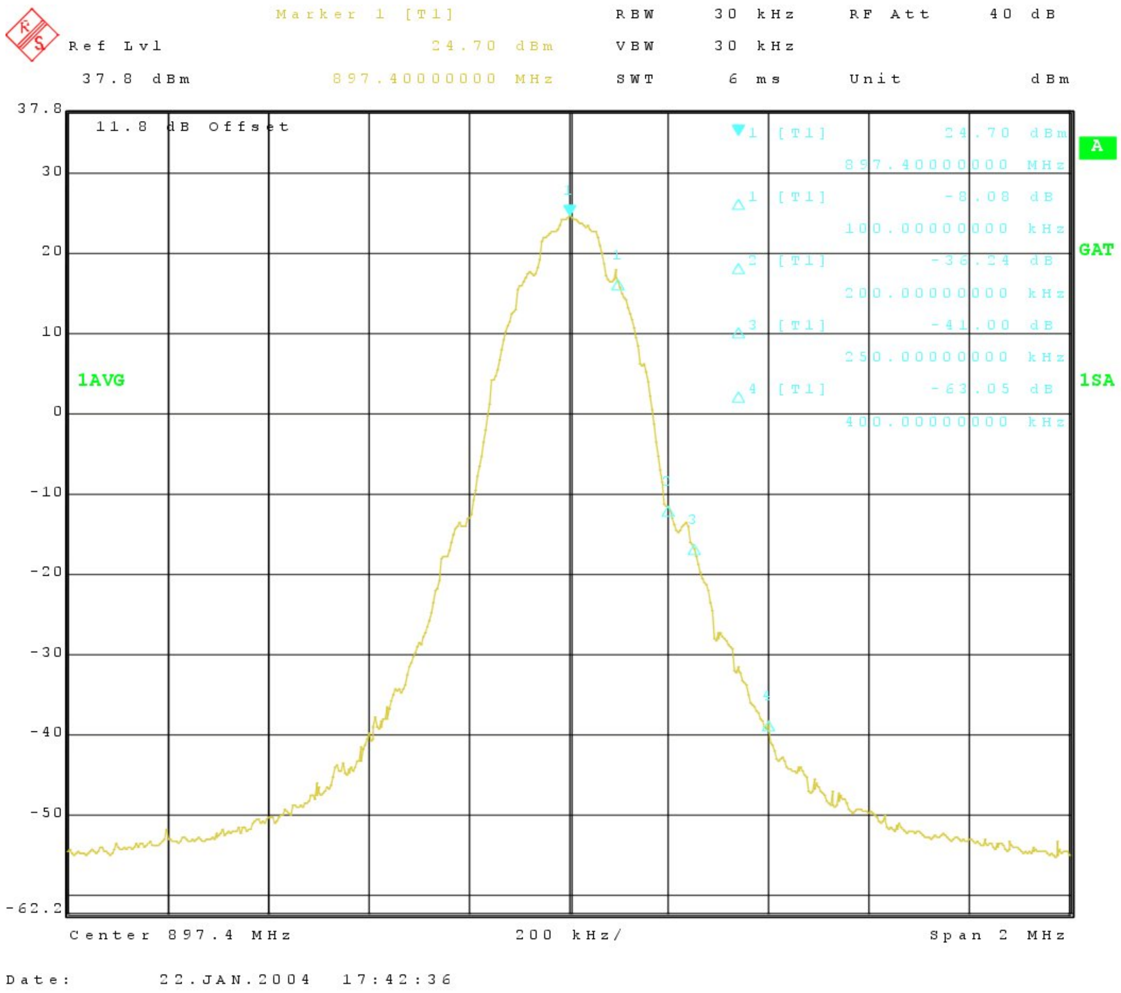
The lower figure is a detail from the upper figure (detail area marked with a white box).

4.6.7 RX VC in GSM mode (DC Offset 1.5 V)


1 On
2 On
100 mV/
3 On
4 On
D On
RX VC
H
1.00 ms/
-1.8200000000 ms
0
T
197.0 mA

DC value changes if channel or band is changed. Upper figure has been taken in GSM850/EGSM900 band and on channel 37.

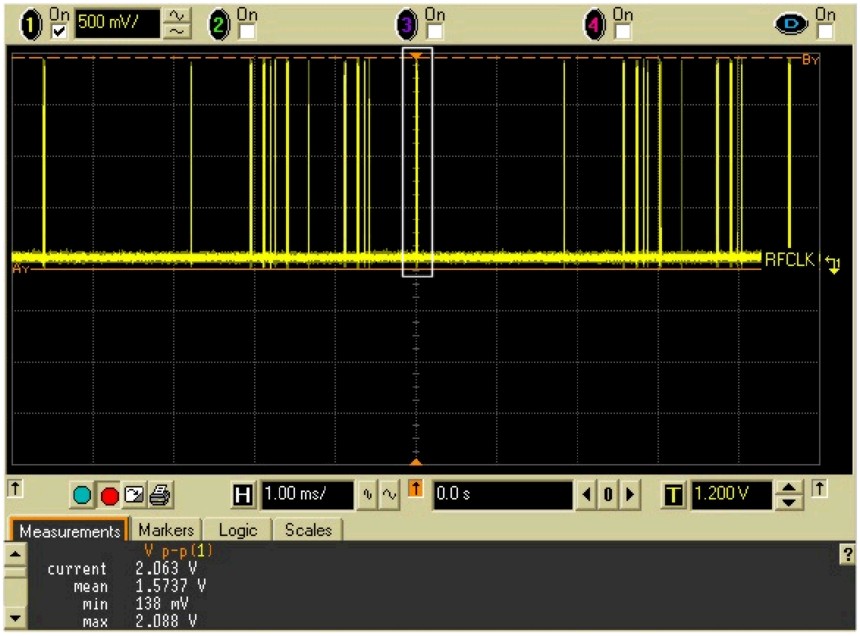
4.6.8 TX Modulation spectrum (GSM)



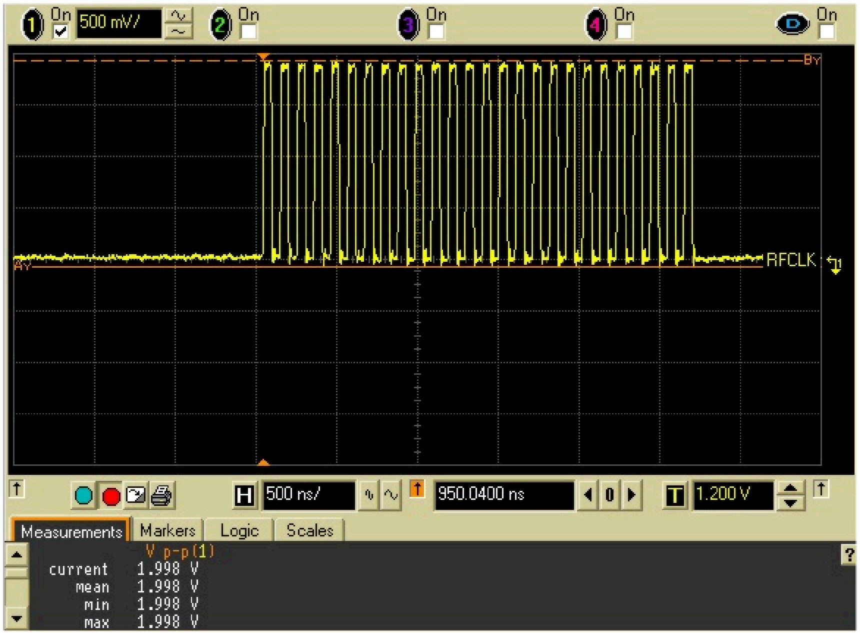
Example of the TX modulation spectrum (GMSK) in GSM850/EGSM900 band.

4.6.9 RFBUS

4.6.9.1 RFBUSCLK (GSM RX)


1 On 500 mV/
2 On
3 On
4 On
D On
BY
RFCLK
AY
H 1.00 ms/
0.0 s
T 1.200 V
Measurements
Markers
Logic
Scales

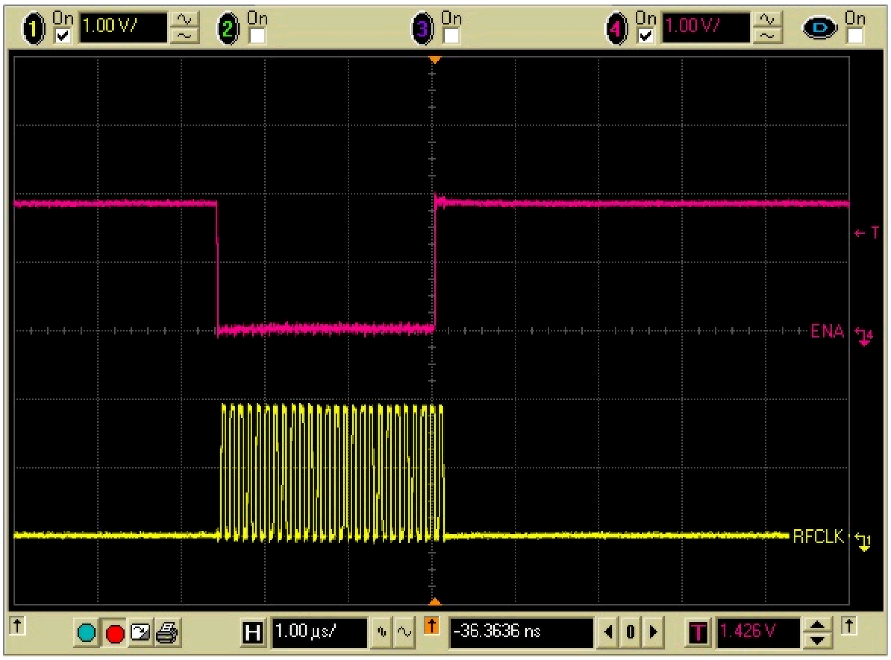
```
      V p-p(1)
current   2.063 V
   mean   1.5737 V
    min   138 mV
    max   2.088 V
```


1 On 500 mV/
2 On
3 On
4 On
D On
BY
RFCLK
AY
H 500 ns/
950.0400 ns
T 1.200 V
Measurements
Markers
Logic
Scales

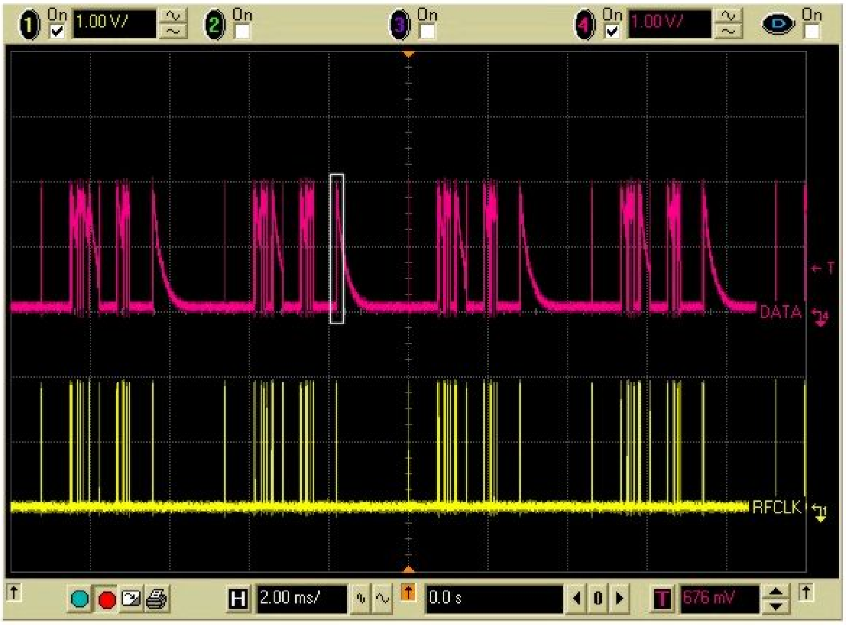
```
      V p-p(1)
current   1.998 V
   mean   1.998 V
    min   1.998 V
    max   1.998 V
```

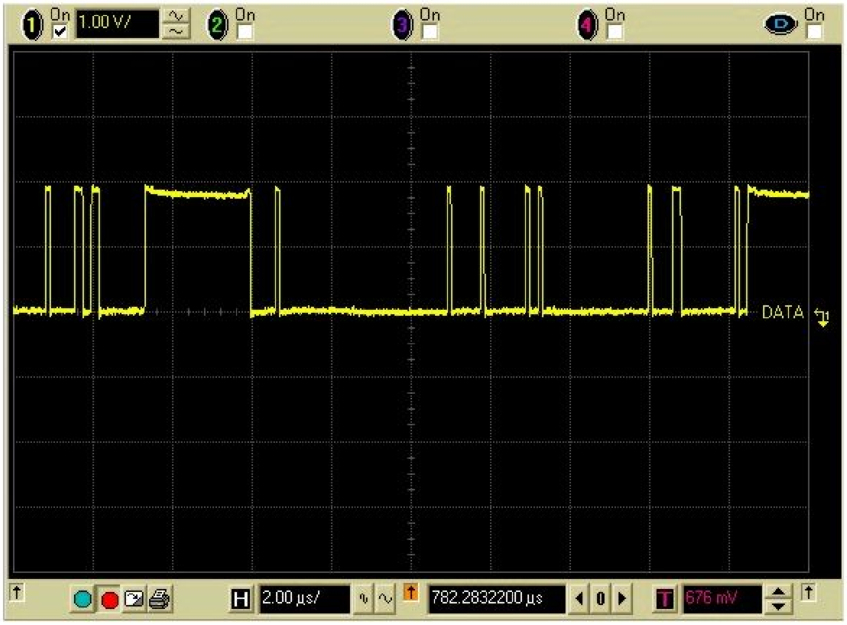
The lower figure is a detail from the upper figure (detail area marked with a white box).

4.6.9.2 RFBUSCLK and RFBUSENA (GSM RX)


1 On ☑ 1.00 V/
2 On ☐
3 On ☐
4 On ☑ 1.00 V/
D On ☐
T
ENA
RFCLK
H 1.00 µs/
-36.3636 ns
0
T 1.426 V

4.6.9.3 RFBUSDAT (GSM RX)


On
1.00 V/
On
On
On
1.00 V/
On
DATA
RFCLK
H 2.00 ms/
0.0 s
T 676 mV


On
1.00 V/
On
On
On
On
DATA
H 2.00 µs/
782.2832200 µs
T 676 mV

The lower figure is a detail from the upper figure (detail area marked with a white box).

8 — Camera Module Troubleshooting

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Introduction to camera module troubleshooting

Background, tools and terminology

Faults or complaints in camera operation can be roughly categorised into three subgroups:

1. Camera is not functional at all; no image can be taken.
2. Images can be taken but there is nothing recognizable in them.
3. Images can be taken and they are recognizable but for some reason the quality of images is seriously degraded.

Image quality is very hard to measure quantitatively, and even comparative measurements are difficult (comparing two images) to do, if the difference is small. Especially if the user is not satisfied with his/her device's image quality, and tells, for example, that the images are not sharp, it is fairly difficult to accurately test the device and get an exact figure which would tell whether the device is functioning properly.

Often subjective evaluation has to be used for finding out if a certain property of the camera is acceptable or not. Some training or experience of a correctly operating reference device may be needed in order to detect what actually is wrong.

It is easy for the user to take bad images in bad conditions. Therefore the camera operation has to be checked always in constant conditions (lighting, temperature) or by using a second, known-to-be good device as reference.

When checking for possible errors in camera functionality, knowing what error is suspected significantly helps the testing by narrowing down the amount of test cases. The following types of image quality problems may be expected to appear:

- Dust (black spots)
- Lack of sharpness
- Bit errors

Terms

Dynamic range	Camera's ability to capture details in dark and bright areas of the scene simultaneously.
Exposure time	Camera modules use silicon sensor to collect light and for forming an image. The imaging process roughly corresponds to traditional film photography, in which exposure time means the time during which the film is exposed to light coming through optics. Increasing the time will allow for more light hitting the film and thus results in brighter image. The operation principle is exactly the same with silicon sensor, but the shutter functionality is handled electronically i.e. there is no mechanical moving parts like in film cameras.
Flicker	Phenomenon, which is caused by pulsating in scene lighting, typically appearing as wide horizontal stripes in an image.
Noise	Variation of response between pixels with same level of input illumination.
Resolution	Usually the amount of pixels in the camera sensor; for example, RM-1 has a 1280 x 960 pixel sensor resolution. In some occasions the term resolution is used for describing the sharpness of the images.
Sensitivity	Camera module's sensitivity to light. In equivalent illumination conditions, a less sensitive camera needs a longer exposure time to gather enough light in forming a good image. Analogous to ISO speed in photographic film.

Sharpness	Good quality images are 'sharp' or 'crisp', meaning that image details are well visible in the picture. However, certain issues, such as non-idealities in optics, cause image blurring, making objects in picture to appear 'soft'. Each camera type typically has its own level of performance.

The effect of image taking conditions on image quality

There are some factors, which may cause poor image quality, if not taken into account by the end user when shooting images, and thus may result in complaints. The items listed are normal to camera operation and are not a reason for changing the camera module.

Distance to target

The lens in the module is specified to operate satisfactorily from 40 cm to infinite distance of scene objects. In practice, the operation is such that close objects may be noticed to get more blurred when distance to them is shorter than 40 cm. The lack of sharpness is first visible in full resolution images. If observing just the viewfinder, even very close objects may seem to appear sharp. This is normal; do not change the camera module.

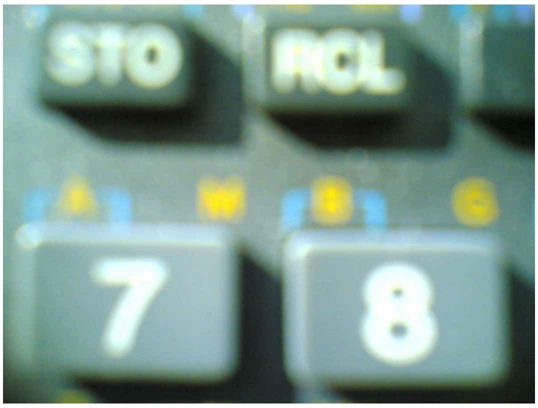


Figure 70 Blurred image. Target too close.

The amount of light available

In dim conditions camera runs out of sensitivity. The exposure time is long (especially in the night mode) and the risk of getting shaken (= blurred) images increases. In addition, image noise level grows. The maximum exposure time in the night mode is ¼ seconds. Therefore, images need to be taken with extreme care and by supporting the phone when the amount of light reflected from the target is low. Because of the longer exposure time and larger gain value, noise level increases in low light conditions. Sometimes blurring may even occur in daytime, if the image is taken very carelessly. See the figure below for an example. This is normal; do not change the camera module.

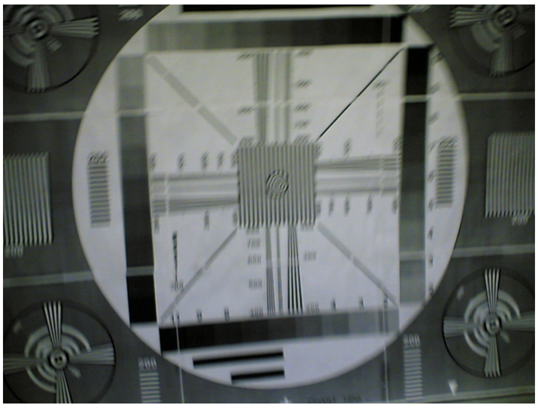


Figure 71 Blurring caused by shaking hands

Movement in bright light

If an image is taken of moving objects or if the device is used in a moving vehicle, object 'skewing' or 'tilting' may occur. This phenomenon is fundamental to most CMOS camera types, and usually cannot be avoided. The movement of camera or object sometimes cause blurring indoors or in dim lighting conditions because of long exposure time. This is normal; do not change the camera module.

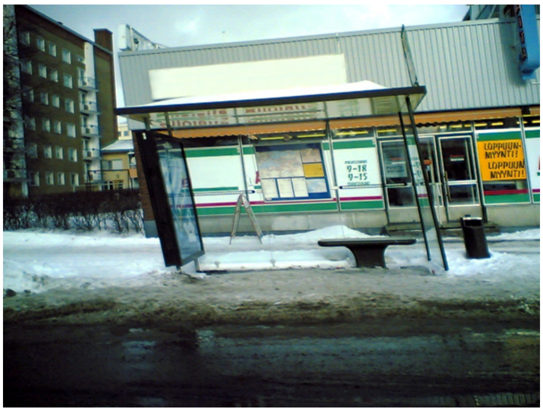


Figure 72 Near objects get skewed when taking images from a moving vehicle

Temperature

High temperatures inside the mobile phone cause more noise to appear in images. For example, in +70 degrees (Celsius), the noise level may be very high, and it further grows if the conditions are dim. If the phone processor has been heavily loaded for a long time before taking an image, the phone might have considerably higher temperature inside than in the surrounding environment. This is also normal to camera operation; do not change the camera module.

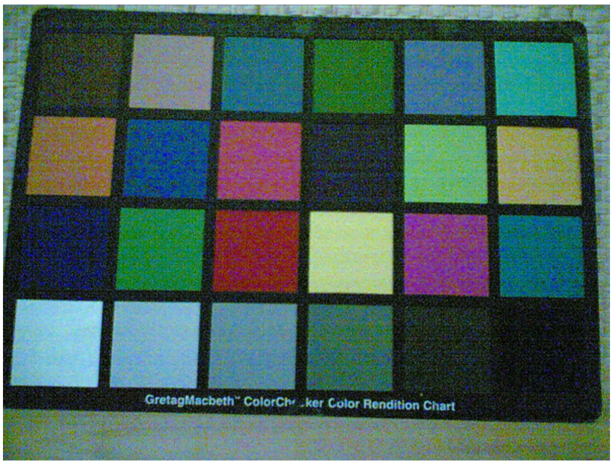


Figure 73 Noisy image taken in +70 degrees Celsius

Phone display

If the display contrast is set too dark, the image quality degrades: the images may be very dark depending on the setting. If the display contrast is set too bright, image contrast appears bad and "faint". This problem is solved by setting the display contrast correctly. This is normal behaviour; do not change the camera module.

Basic rules of photography (especially shooting against light)

Because of dynamic range limitations, taking images against bright light might cause either saturated image or the actual target appear too dark. In practice, this means that when taking an image indoors and having, for example, a window behind the object, the result is usually poor. This is normal behaviour; do not change the camera module.

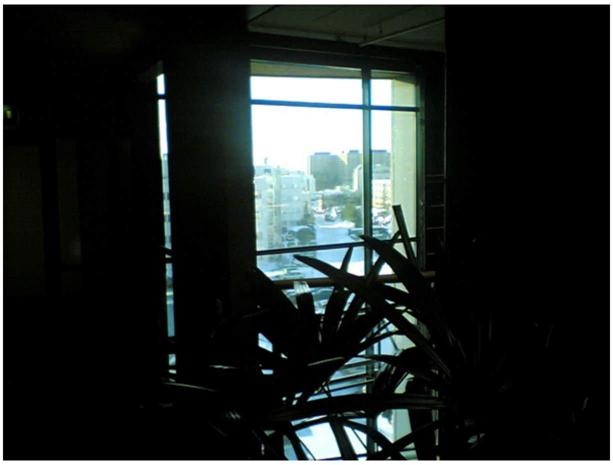


Figure 74 Image taken against light

Flicker

In some occasions a bright fluorescent light may cause flicker in the viewfinder and captured image. This phenomenon may also be a result, if images are taken indoors under the mismatch of 50/60 Hz electricity network frequency. The electricity frequency used is automatically detected by the camera module. In some very few countries, both 50 and 60 Hz networks are present and thus probability for the phenomenon increases. Flickering occurs also under high artificial illumination level. This is normal behaviour; do not change the camera module.

Figure 75 Flicker in an image; object illuminated by strong fluorescent light

Bright light outside of image view

Especially the sun can cause clearly visible lens glare phenomenon and poor contrast in images. This happens because of undesired reflections inside the camera optics. Generally this kind of reflections are common in all optical systems. This is normal behaviour; do not change the camera module.

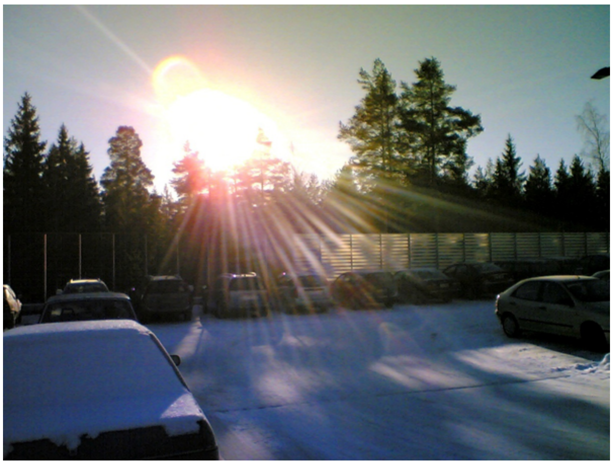


Figure 76 A lens reflection effect caused by sunshine

Examples of good quality images

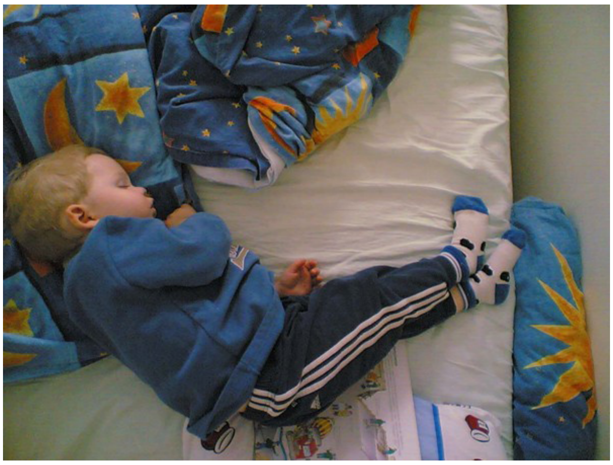


Figure 77 Good image taken indoors

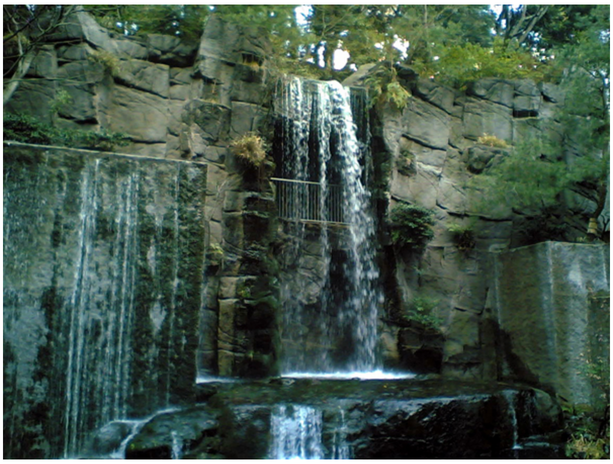


Figure 78 Good image taken outdoors

■ Camera construction

This section describes the mechanical construction of the camera module for getting a better understanding of the actual mechanical structure of the module.

Table 17 Camera specifications

Sensor type	CMOS Sensor
Photo detectors	1.3 million
F number/Aperture	f/3.2
Focal length	4.5mm (35mm equivalent 37mm)
Focus range	40 cm to infinity
Still Image resolutions	1280 x 960, 640 x 480
Still images file format	EXIF (JPEG), *.jpg
Video resolutions	176 x 144, 128 x 96 both 15 frames per second

Video clip length	10 seconds or free, maximal clip length in free mode is 1 hour
Video file format	3GPP, *.3gp
Exposure	Automatic
White Balance	Automatic
ISO	250 – 2000 (Automatic)
Colours	16.7 million / 24-bit
Capture Modes	Night mode, Sequence mode, self timer

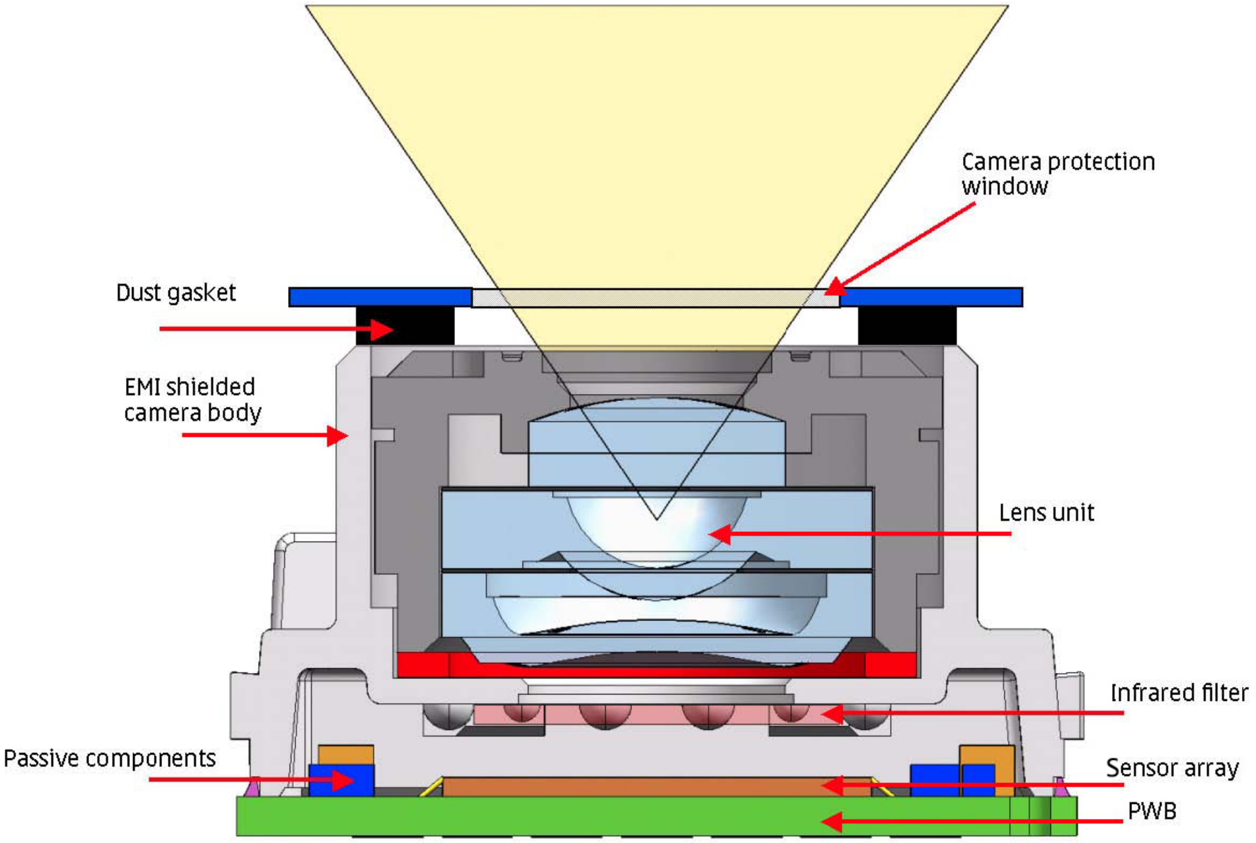

Camera protection window
Dust gasket
EMI shielded camera body
Lens unit
Infrared filter
Passive components
Sensor array
PWB

Figure 79 Camera module cross section and assembly principle

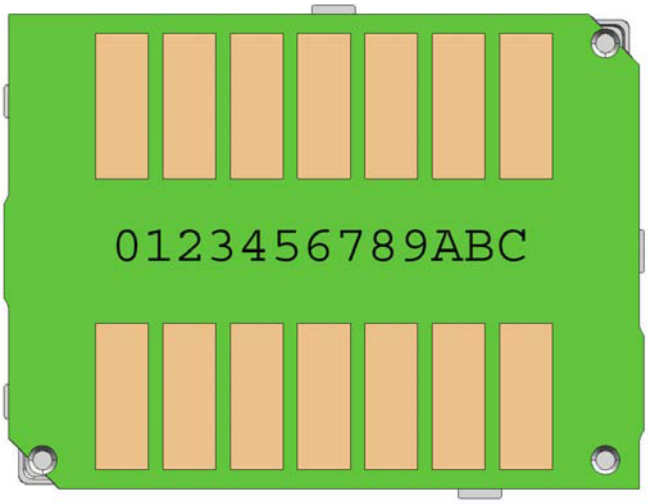


Figure 80 Camera module bottom view including serial numbering

The camera module as a component is not a repairable part, meaning that the components inside the module may not be changed. Cleaning dust from the front face is allowed only. Use clean compressed air.

The camera module uses socket type connecting. For versioning, laser marked serial numbering is used on the PWB.

The main parts of the module are:

- Lens unit including lens aperture.
- Infrared filter; used to prevent infrared light from contaminating the image colors. The IR filter is glued to the EMI shielded camera body.
- Camera body; made of conductive metallized plastic and attached to the PWB with glue.
- Sensor array including DSP functions is glued and wire-bonded to the PWB.
- PWB, FR-4 type
- Passive components
- Camera protection window; part of the phone cover mechanics
- Dust gasket between the lens unit and camera protection window

Image quality analysis

Testing for dust in camera module

Context

For detecting these kinds of problems, take an image of a uniform white surface and analyse it in full resolution. A good quality PC monitor is preferred for analysis. Search carefully, since finding these defects is not always easy. Figure "Effects of dust on optical path" is an example image containing easily detectable dust problems.

When taking a white image, use uniformly lightened white paper or white wall. One possibility is to use uniform light but in this case make sure that the camera image is not flickering when taking the test image. In case flickering happens, try to reduce illumination level. Use JPEG image format for analysing, and set the image quality parameter to ‘High Quality’.

Black spots in an image are caused by dirt particles trapped inside the optical system. Clearly visible and sharp edged black dots in an image are typically dust particles on the image sensor. These spots are searched for in the manufacturing phase, but it is possible that the camera body cavity contains a particle, which may move onto the image sensor active surface, for example, when the phone is dropped. Thus it is also possible that the problem will disappear before the phone is brought to service. The camera should be replaced if the problem is present when the service technician analyses the phone.

If a dust particle is lying on the infrared filter surface on either side, they are hard to locate because they are out of focus, and appear in the image as large, grayish and fading-edge 'blobs'. Sometimes they are invisible to the eye, and thus the user probably does not notice them at all. However, it is possible that a larger particle disturbs the user, causing need for service.

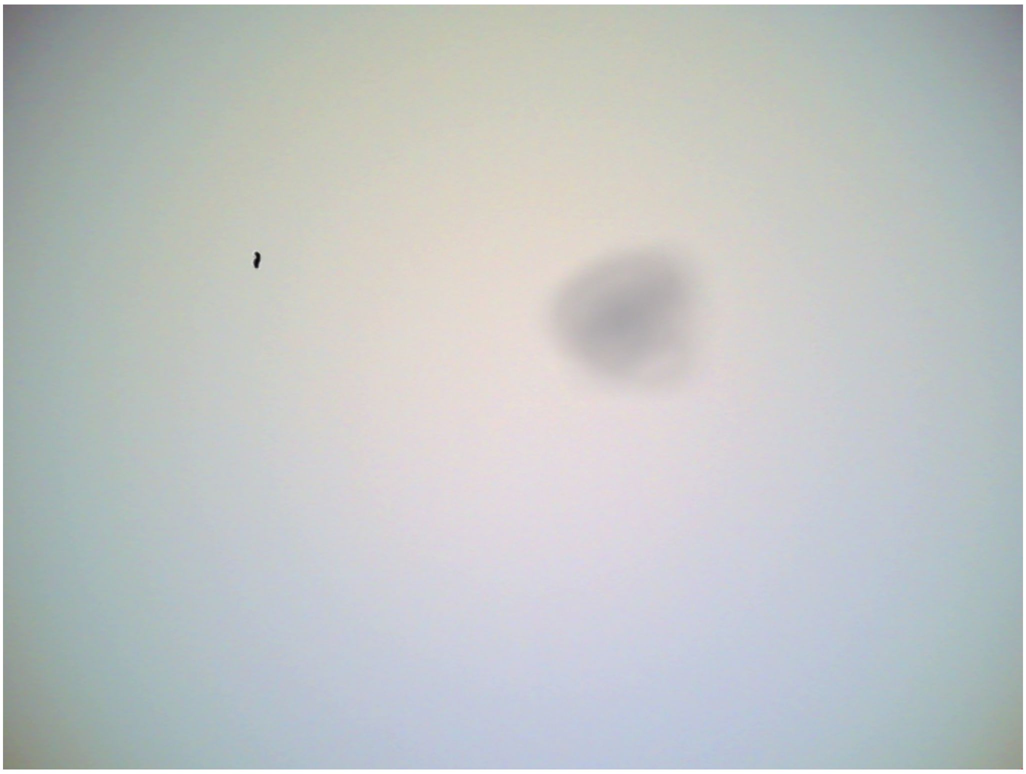


Figure 81 Effects of dust on optical path

If large dust particles get trapped on top of the lens surface in the cavity between camera window and lens, they will cause image blurring and poor contrast. The dust gasket between the window and lens should prevent any particles from getting into the cavity after the manufacturing phase.

If dust particles are found on the sensor, this is classified as a manufacturing error of the module and the camera should be replaced. Any particles inside the cavity between the protection window and lens have most probably been trapped there in the assembly phase at a Nokia factory. Unauthorized disassembling of the product can also be the root of the problem. However, in most cases it should be possible to remove the particle(s) by using clean compressed air. Never wipe the lens surface before trying compressed air; the possibility of damaging the lens is substantial. Always check the image sharpness after removing dust.

See Also

- Testing camera image sharpness (Page 8–13)

Testing camera image sharpness

Context

If pictures taken with a device are claimed to be blurry, there are six possible sources for the problem:

1 The protection window is fingerprinted, soiled, dirty, visibly scratched or broken.

2 The photographed object is too close – the camera lens operates with distances from 40 cm to infinity. This is no cause to replace camera module.

3 User has tried to take pictures in too dark conditions, and images are blurred due to handshake or movement. This is no cause to replace camera module.

4 There is dirt between the protection window and camera lens.

5 The protection window is defective. This can be either a manufacturing failure or caused by the user. The window should be changed.

6 The camera lens is misfocused because of a manufacturing error.

A quantitative analysis of sharpness is very difficult to conduct in any other environment than optics laboratory. Therefore, subjective analysis should be used.

If no visible defects (items 1-4) are found, a couple of test images should be taken. Generally, a well-illuminated typical indoor scene can be used as a target. The main considerations are:

- The protection window has to be clean.
- The amount of light (300 – 600 lux (bright office lighting)) is sufficient.
- The scene should contain, for example, small objects for checking sharpness. Their distance should be 1 – 2 meters.
- If possible, compare the image to another image of the same scene, taken with a different device. Note that the reference device has to be a similar Nokia phone.

Steps

1. Take several images of small objects in the distance of 1-2 metres.
2. Analyse the images on a PC screen at 100% scaling with the reference images.

   Pay attention to the computer display settings: at least 65000 colors (16-bit) have to be used. True colour (24-bit, 16 million colours) or 32-bit (full colour) setting is recommended.

Next action

If there appears to be a clearly noticeable difference between the reference image and the test images, the module might have a misfocused lens -> change the module.

Re-check the resolution after changing the camera module.

If the changed module produces the same result, the fault is probably in the camera window. Check the window by looking carefully through it when replacing the module.

See Also

- Testing for dust in camera module (Page 8–12)
- Dirty camera protection window (Page 8–14)

Dirty camera lens protection window

The following series of images demonstrates the effects of fingerprints on the camera protection window.

It should be noted that the effects of any dirt in images can vary much. It may be difficult to judge whether the window has been dirty or if something else is wrong. Therefore, the cleanness of the protection window should always be checked and the window should be wiped clean with a suitable cloth.

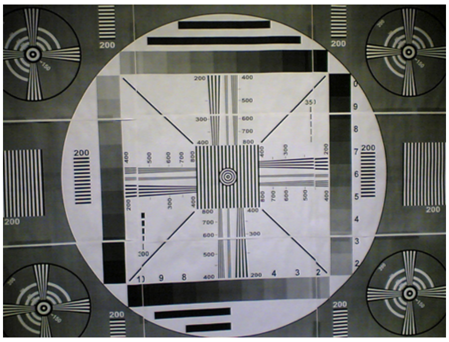


Figure 82 Image taken with clean protection window

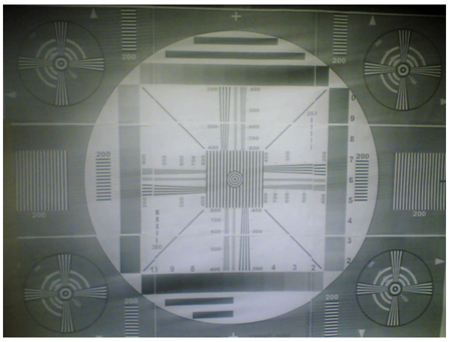


Figure 83 Image taken with greasy protection window

Image bit errors

Bit errors are image defects caused by data transmission errors between the camera module and the phone baseband and/or errors inside the module.

Usually bit errors can be easily detected in images, and they are best visible in full resolution images. A good practice is to use a uniform white test target when analysing these errors. The errors are clearly visible, colourful sharp dots or lines in camera images. See the following figure.

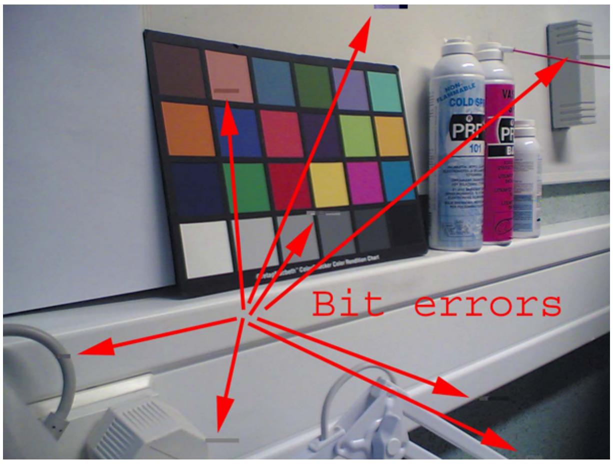


Figure 84 Bit errors caused by JPEG compression

One type of bit error is a lack of bit depth. In this case, the image is almost totally black under normal conditions, and only senses something in very highly illuminated environments. Typically this is a contact problem between the camera module and the phone main PWB. You should check the camera assembly and connector contacts.

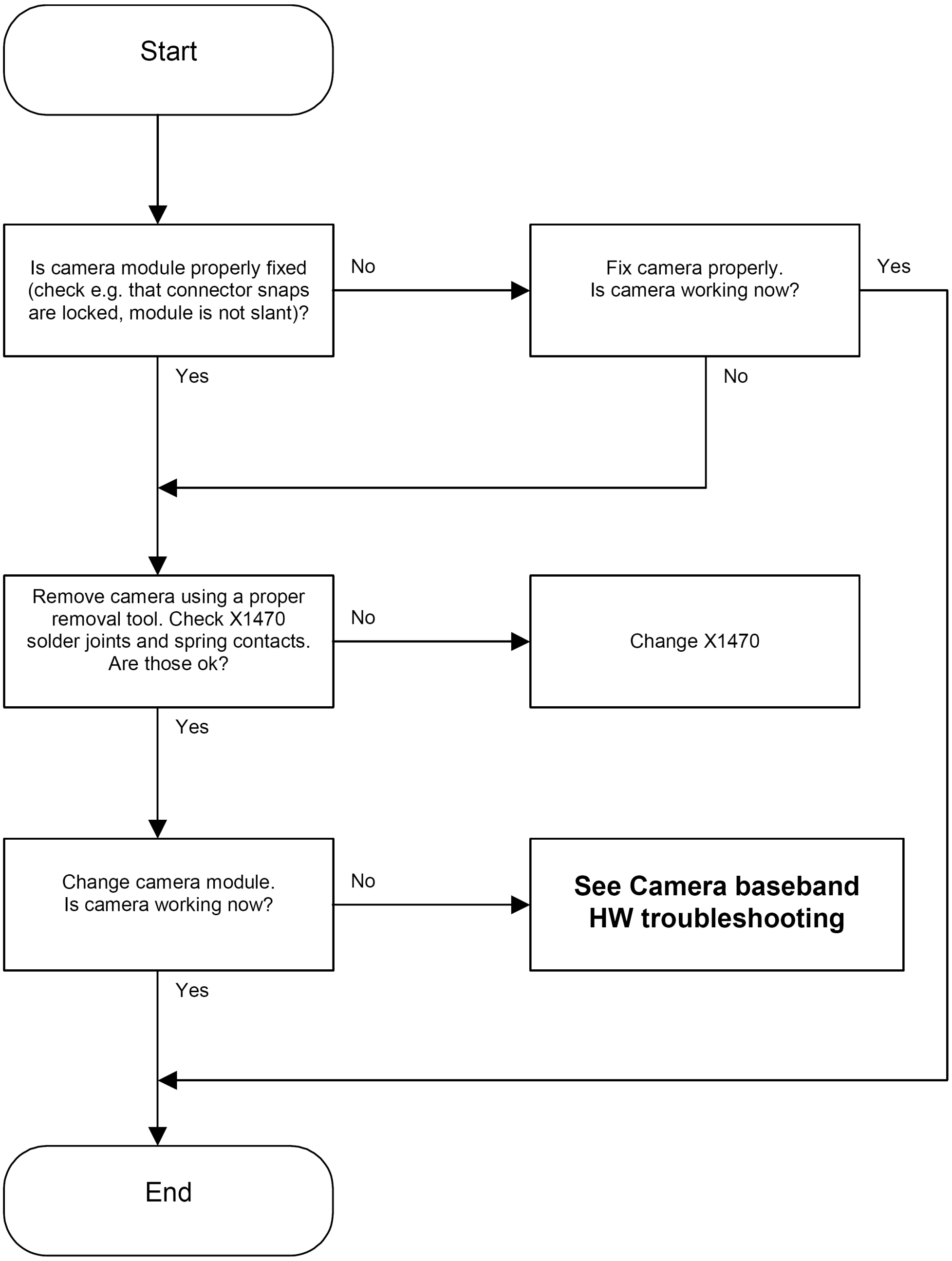
If the fault is in the camera module, bit errors are typically visible only when using some specific image resolution. For example, in case of a viewfinder fault, the error might exist but is not visible in a full size image.

■ Camera troubleshooting flowcharts

Camera hardware failure message troubleshooting

Context

If you get a hardware failure message when using the camera, follow the next troubleshooting flowchart.


Start
Is camera module properly fixed (check e.g. that connector snaps are locked, module is not slant)?
No
Fix camera properly. Is camera working now?
Yes
Yes
No
Remove camera using a proper removal tool. Check X1470 solder joints and spring contacts. Are those ok?
No
Change X1470
Yes
Change camera module. Is camera working now?
No
See Camera baseband HW troubleshooting
Yes
End

Note: Make sure that the phone has the latest software before continuing.

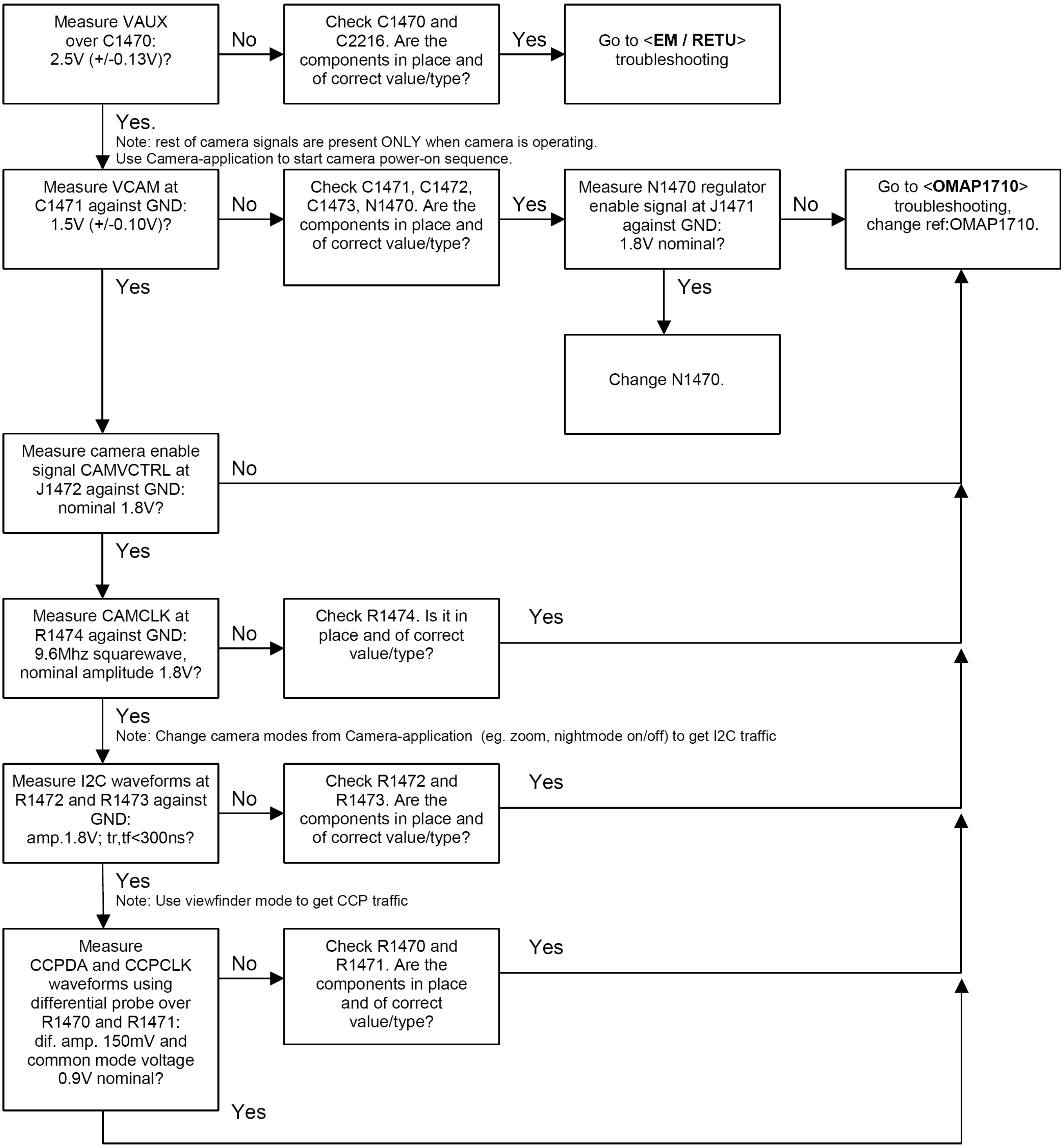
Results

The camera is working properly.

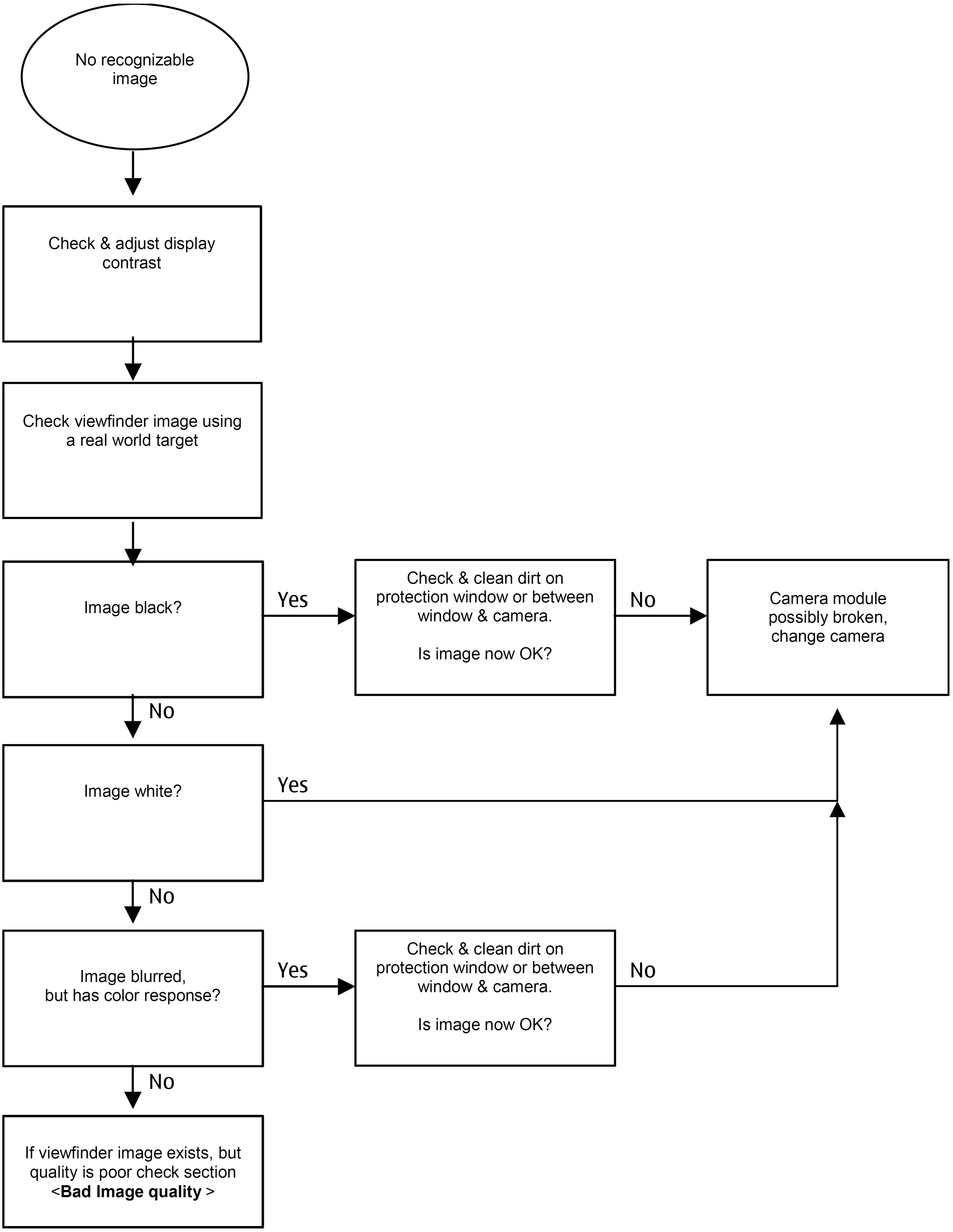
Next action

If there are still problems with the camera, see "Camera baseband hardware troubleshooting".

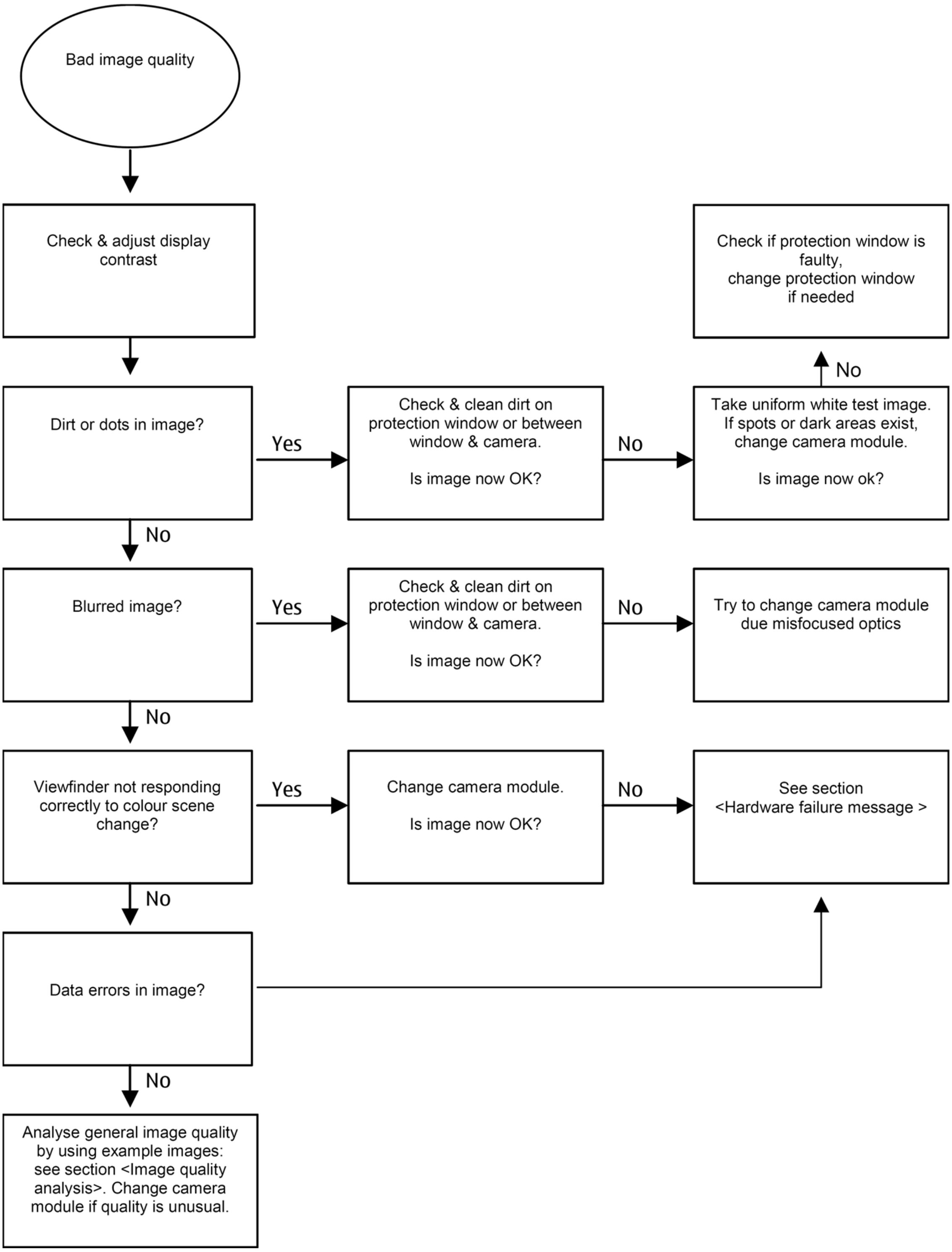
Camera baseband HW troubleshooting


Measure VAUX over C1470: 2.5V (+/-0.13V)?
No
Check C1470 and C2216. Are the components in place and of correct value/type?
Yes
Go to <**EM / RETU**> troubleshooting
Yes.
Note: rest of camera signals are present ONLY when camera is operating.
Use Camera-application to start camera power-on sequence.
Measure VCAM at C1471 against GND: 1.5V (+/-0.10V)?
No
Check C1471, C1472, C1473, N1470. Are the components in place and of correct value/type?
Yes
Measure N1470 regulator enable signal at J1471 against GND: 1.8V nominal?
No
Go to <**OMAP1710**> troubleshooting, change ref:OMAP1710.
Yes
Yes
Change N1470.
Measure camera enable signal CAMVCTRL at J1472 against GND: nominal 1.8V?
No
Yes
Measure CAMCLK at R1474 against GND: 9.6Mhz squarewave, nominal amplitude 1.8V?
No
Check R1474. Is it in place and of correct value/type?
Yes
Yes
Note: Change camera modes from Camera-application (eg. zoom, nightmode on/off) to get I2C traffic
Measure I2C waveforms at R1472 and R1473 against GND: amp.1.8V; tr,tf<300ns?
No
Check R1472 and R1473. Are the components in place and of correct value/type?
Yes
Yes
Note: Use viewfinder mode to get CCP traffic
Measure CCPDA and CCPCLK waveforms using differential probe over R1470 and R1471: dif. amp. 150mV and common mode voltage 0.9V nominal?
No
Check R1470 and R1471. Are the components in place and of correct value/type?
Yes
Yes

Camera viewfinder troubleshooting


No recognizable image
Check & adjust display contrast
Check viewfinder image using a real world target
Image black?
Yes
Check & clean dirt on protection window or between window & camera.
Is image now OK?
No
Camera module possibly broken, change camera
No
Image white?
Yes
No
Image blurred, but has color response?
Yes
Check & clean dirt on protection window or between window & camera.
Is image now OK?
No
No
If viewfinder image exists, but quality is poor check section <**Bad Image quality** >

Bad camera image quality troubleshooting


Bad image quality
Check & adjust display contrast
Dirt or dots in image?
Yes
Check & clean dirt on protection window or between window & camera. Is image now OK?
No
Take uniform white test image. If spots or dark areas exist, change camera module. Is image now ok?
No
Check if protection window is faulty, change protection window if needed
No
Blurred image?
Yes
Check & clean dirt on protection window or between window & camera. Is image now OK?
No
Try to change camera module due misfocused optics
No
Viewfinder not responding correctly to colour scene change?
Yes
Change camera module. Is image now OK?
No
See section <Hardware failure message >
No
Data errors in image?
No
Analyse general image quality by using example images: see section <Image quality analysis>. Change camera module if quality is unusual.

See Also

- Camera hardware failure message troubleshooting (Page 8–15)

Flash LED troubleshooting

Introduction to flash LED troubleshooting

A fault or complaint associated to LED flash operation can be roughly categorized to two subgroups:

1. Flash is not functional at all (no light output at all).
2. Images can be taken and they are recognizable but for some reason the quality of images is seriously degraded.

Image quality is very hard to measure quantitatively, and even comparative measurements are difficult (comparing two images) if the difference is small. Especially if the user is not satisfied with his/her devices' image quality, it is fairly difficult to accurately test the device and get an exact figure which then would tell if the device is OK or not.

Most often, subjective evaluation has to be used for finding out if there is something wrong in the flash. Some training or experience of a correctly operating reference device may be needed in order to detect what actually is wrong, or is there anything wrong at all. It is easy for the user to take bad looking images in bad conditions; thus the camera and the flash operation has to be checked always in constant conditions (lighting, temperature) or by using a second, known to be good device as a reference. Experience significantly helps in analyzing image quality.

Flash LED and image taking conditions

This section describes some of the factors, which may cause poor image quality if not taken into account by the end user when shooting pictures, and thus may result in complaints. The described items are normal to the camera and LED flash operation and do not cause a need for e.g. changing the flash module.

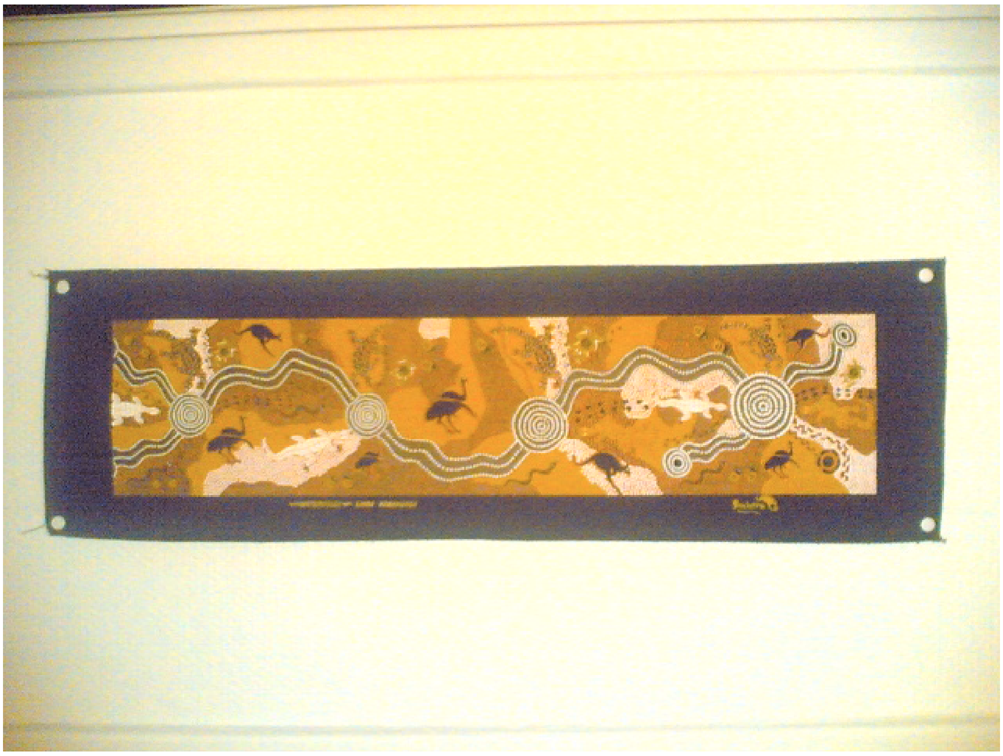


Figure 85 Example of a good quality image taken with the flash LED

Distance to the target (too close)

There is no feedback in the flash system, which means that the light output is constant in every situation. This causes the images to overexposure, when shot from close distance. The flash LED is designed to work optimally way between distances of 50cm – 1.20m.

This is normal behaviour; do not change the flash module.

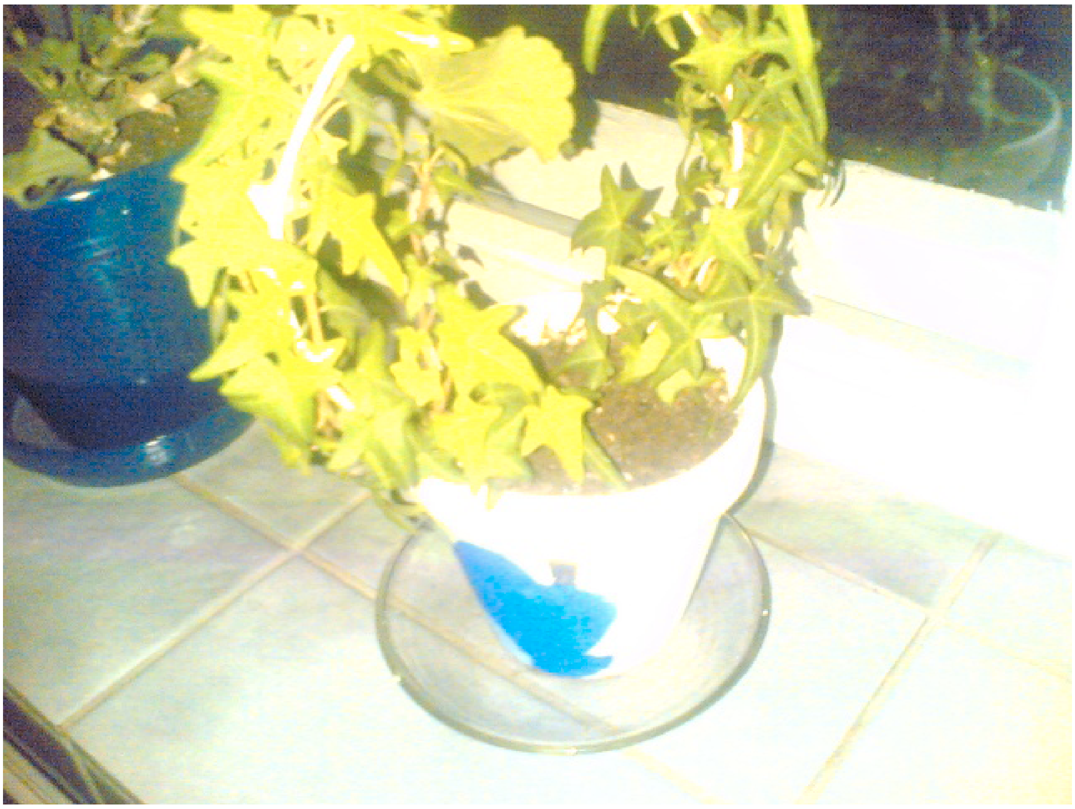


Figure 86 overexposed image

Distance to the target (too far away):

The power of white LED flash is still very modest compared to xenon flash technology. Even with the full power, the maximum distance for the acceptable image quality is roughly 1.2m. If the distance is greater than 1.2m, the images will appear dark and the noise level increases.

This is normal behaviour; do not change the flash module.

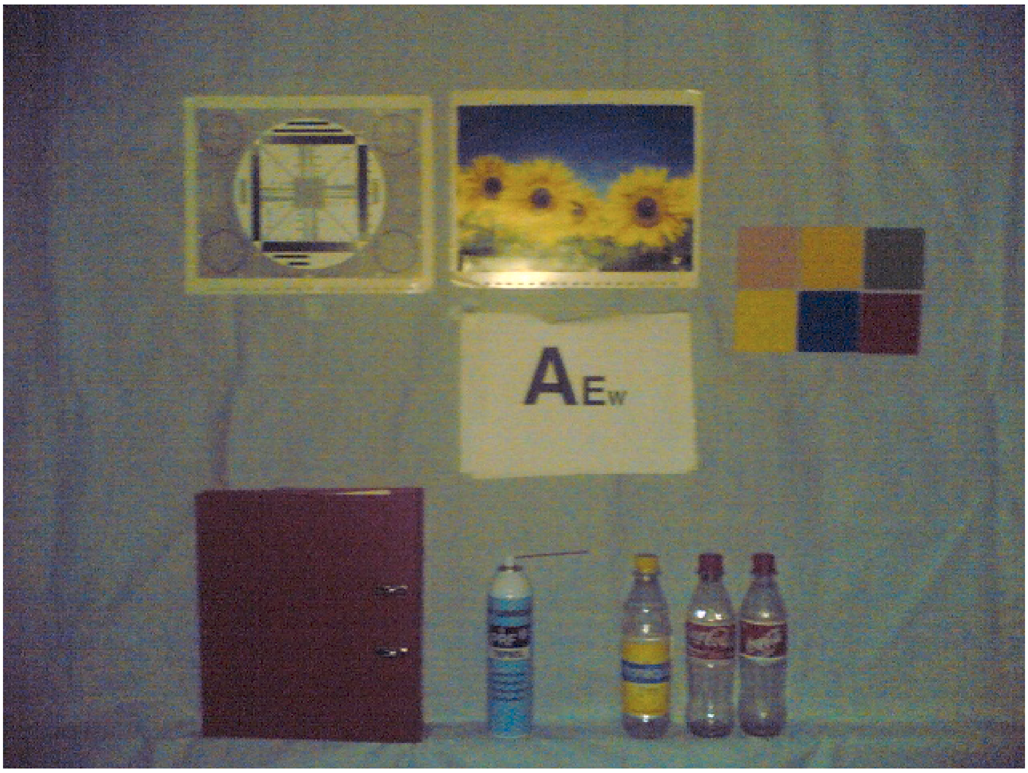


Figure 87 Dark and noisy image

Shaken (= blurred) images

Traditional xenon flash has the advantage of stopping the movement. This is result of extremely short and intense light pulse, which makes it possible for camera to use very short exposure time. Due to weak output of the LED flash, the exposure time has to be actually increased from the viewfinder mode in total darkness, instead of shortening it. This allows the sensor to integrate longer and collect more light but also easily creates blurred images if care is not taken.

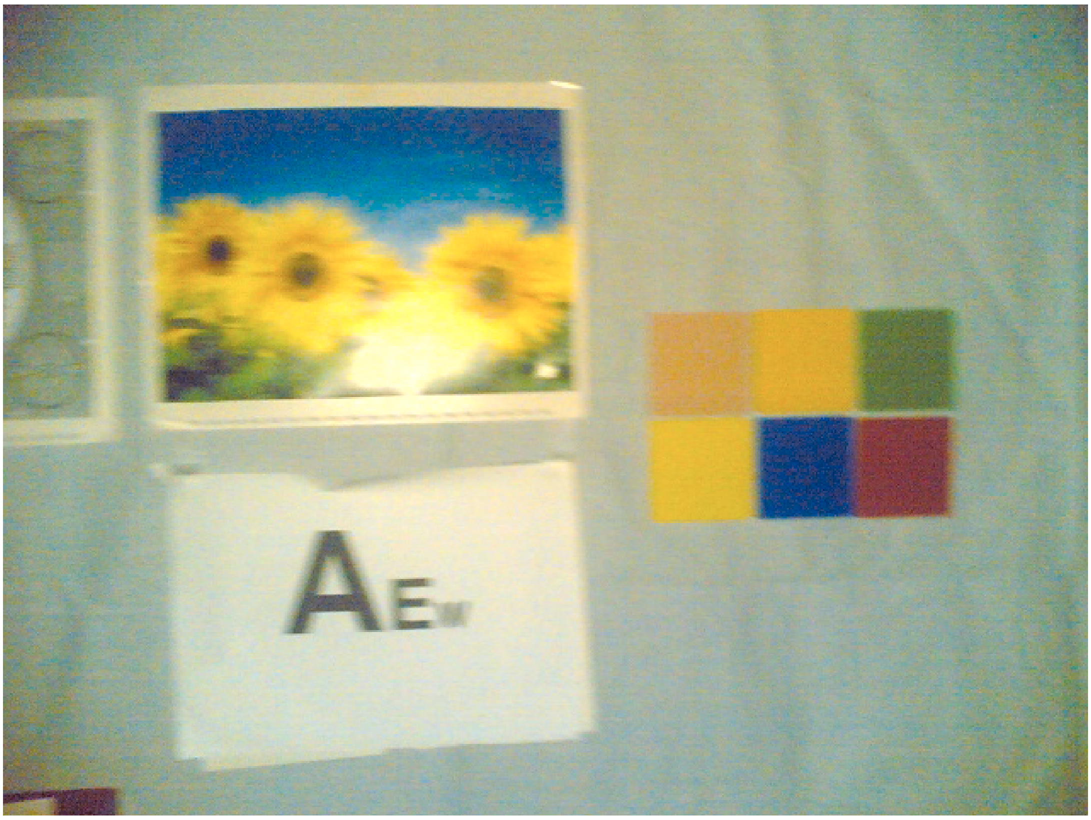


Figure 88 Shaken image

Camera white balance failure and overexposure due to presence of ambient light

Because the spectral output of the flash is known, the white balance and the exposure control of the camera work in optimal way with the flash in total darkness. This is why some of the pictures may fail, if there is some ambient light present when the image is taken.

If the flash works correctly in dark, there is no need to change the flash module.

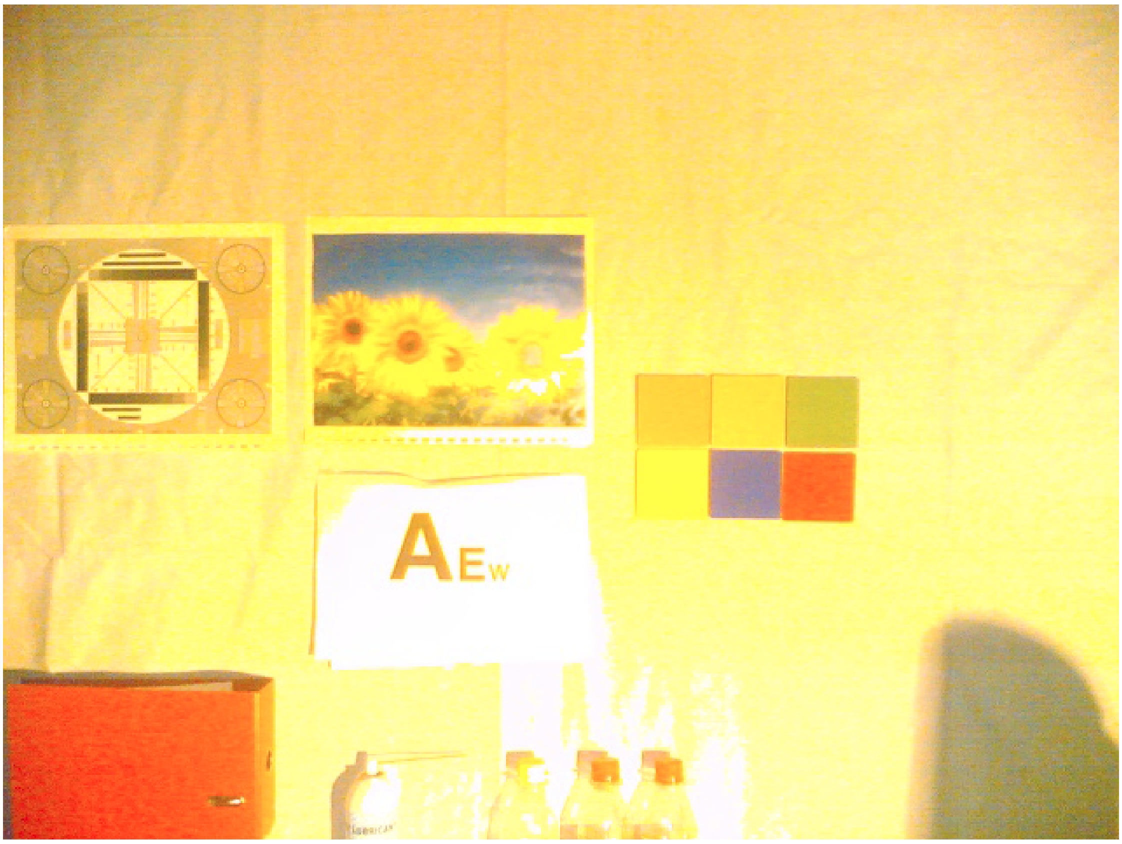


Figure 89 Camera white balance failure and overexposure

Colour difference between different modules

There is variation in the spectrum of the flash, which derives from the manufacturing process of the white LEDs. Because of this variation, there may be some variation in the colour of the images.

This is normal behavior; do not change the flash module.

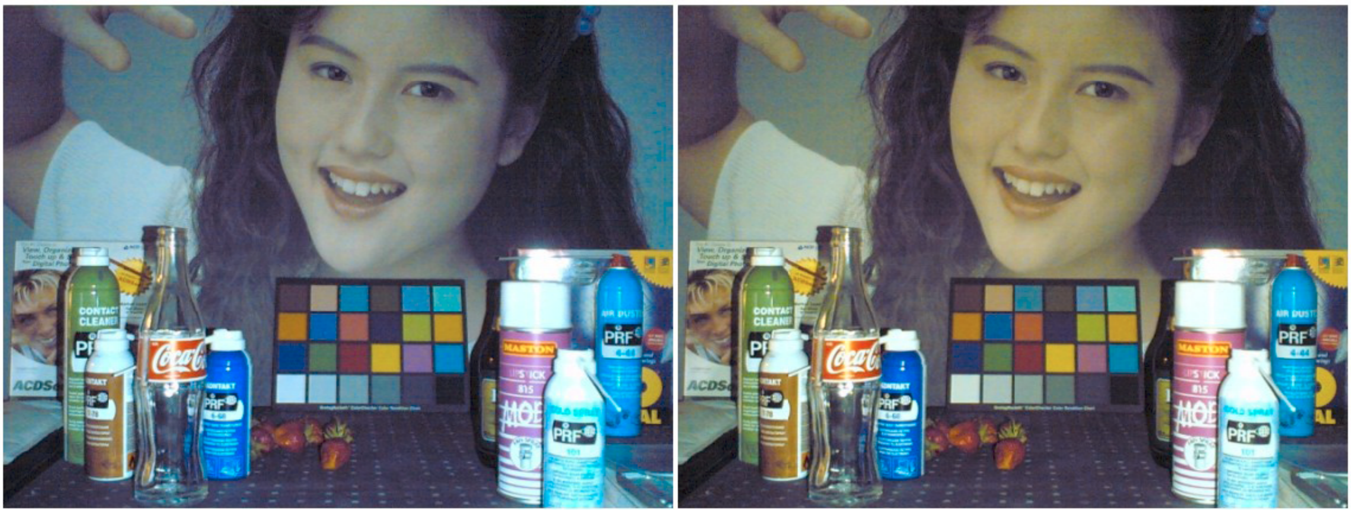


Figure 90 Color difference between flash colour limit samples

Flash LED construction

This section describes the actual construction of the LED flash module for getting a better understanding of the mechanics of the module.

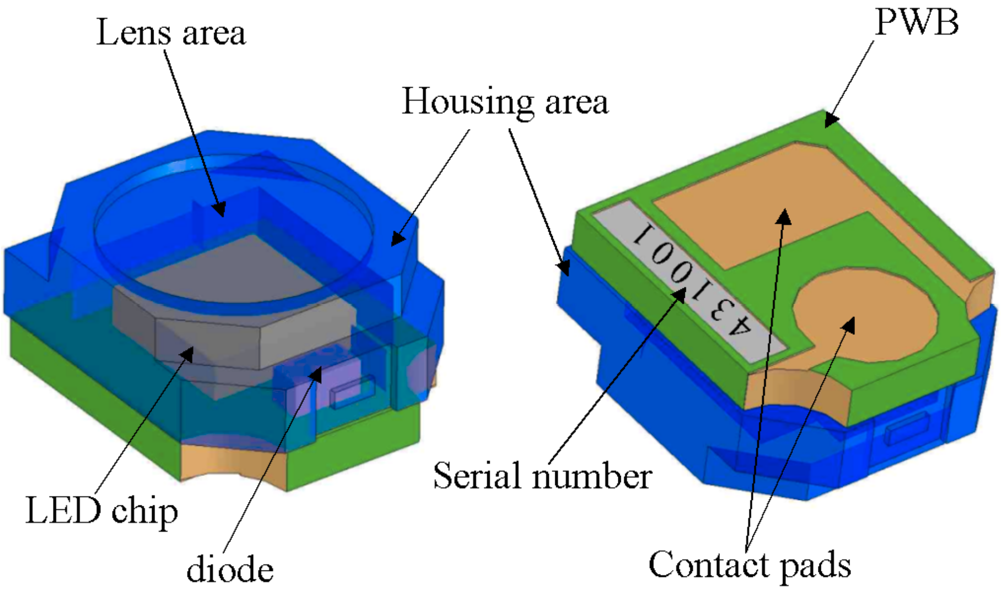


Figure 91 Mechanical construction of the flash LED module

The flash LED module as a component is not a repairable part, i.e. components / parts in the module cannot be changed. Only cleaning dust from the lens is allowed; use clean compressed air.

The main parts of the module are:

- Housing, which is glued to the PWB
- Lens area (round area on top of the housing with circle patterns)
- LED chip (yellow chip inside the housing), which is soldered to the PWB
- ESD protection diode (black passive component inside the housing), which is soldered to the PWB
- PWB
- Contact pads
- Laser marked serial number

The flash LED is fixed to the phone mechanics with special clips. The contacts to the main PWB are formed by using spring connectors.

Analysing image quality

Possible faults in image quality

When checking for possible errors in the flash functionality, knowing what error is suspected will significantly help the testing by narrowing down the amount of test cases. The following types of image quality problems may be expected to appear:

- LED module is not flashing at all
- Image colours are not good
- Flash power is weak

Testing flash module functionality

For testing the module's overall functionality, take an image with the flash and monitor at same time whether the LED module flashes.

To do this test always use the FORCED FLASH mode in the phone, not the AUTOMATIC mode. The FORCED FLASH mode enforces the LED module to flash, even if there is some ambient light in present.

Testing image colours with flash

For testing image colours with flash, take an image of the target, which contains something white. You should take the image in total darkness and from less than 1m range.

If the white target appears to be white, the flash is working correctly. However, remember that there is some variation in the flash colour from module to module. For more information, see section "Colour difference between different modules" in "Flash LED and image taking conditions".

Testing flash power

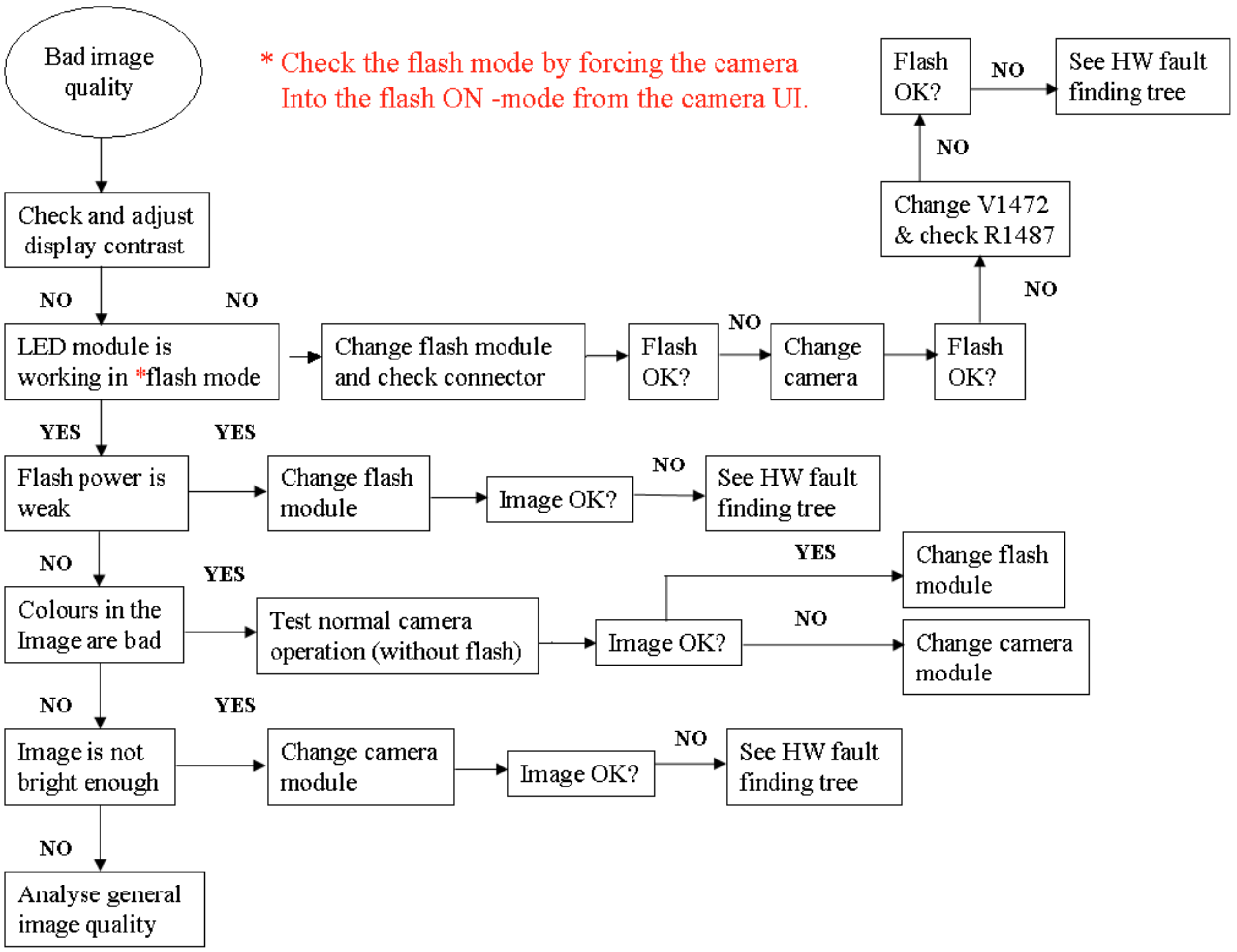
For testing flash power, take an image with the flash in total darkness (ambient light level < 1 lux) from a target about 80cm – 1m away.

If the flash is working normally with adequate power level, the image is correctly exposed from 80cm – 1m distances.

Remember that the brightness level in the corners is always less than in the center of the image because of camera and flash optics.

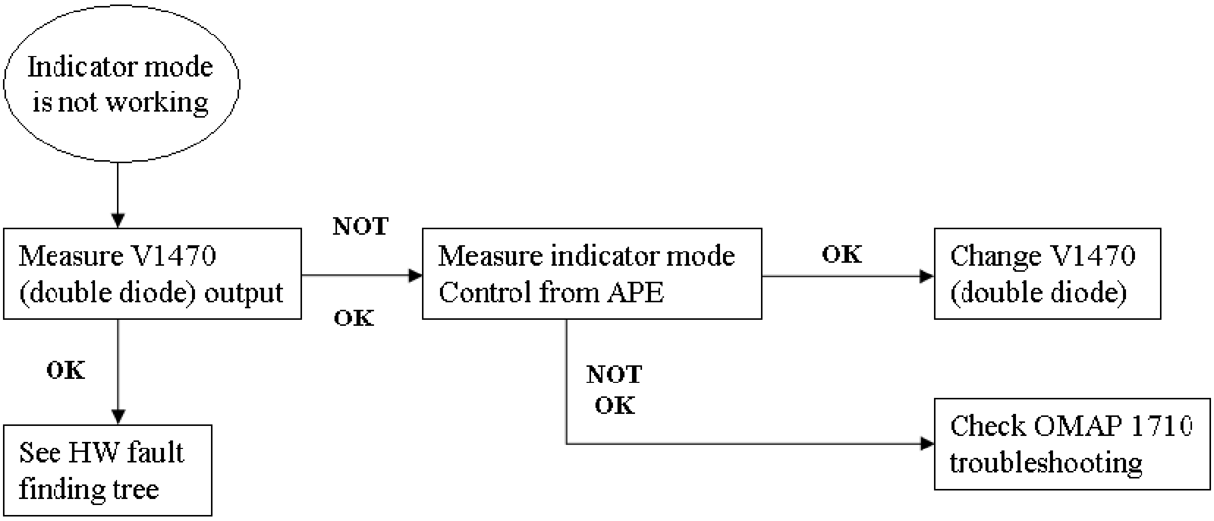
Flash LED troubleshooting flowcharts

Bad image quality when using flash LED


Bad image quality
* Check the flash mode by forcing the camera Into the flash ON -mode from the camera UI.
Flash OK?
NO
See HW fault finding tree
NO
Change V1472 & check R1487
NO
Check and adjust display contrast
NO
NO
LED module is working in *flash mode
Change flash module and check connector
Flash OK?
NO
Change camera
Flash OK?
YES
YES
Flash power is weak
Change flash module
Image OK?
NO
See HW fault finding tree
NO
YES
YES
Change flash module
Colours in the Image are bad
Test normal camera operation (without flash)
Image OK?
NO
Change camera module
NO
YES
Image is not bright enough
Change camera module
Image OK?
NO
See HW fault finding tree
NO
Analyse general image quality

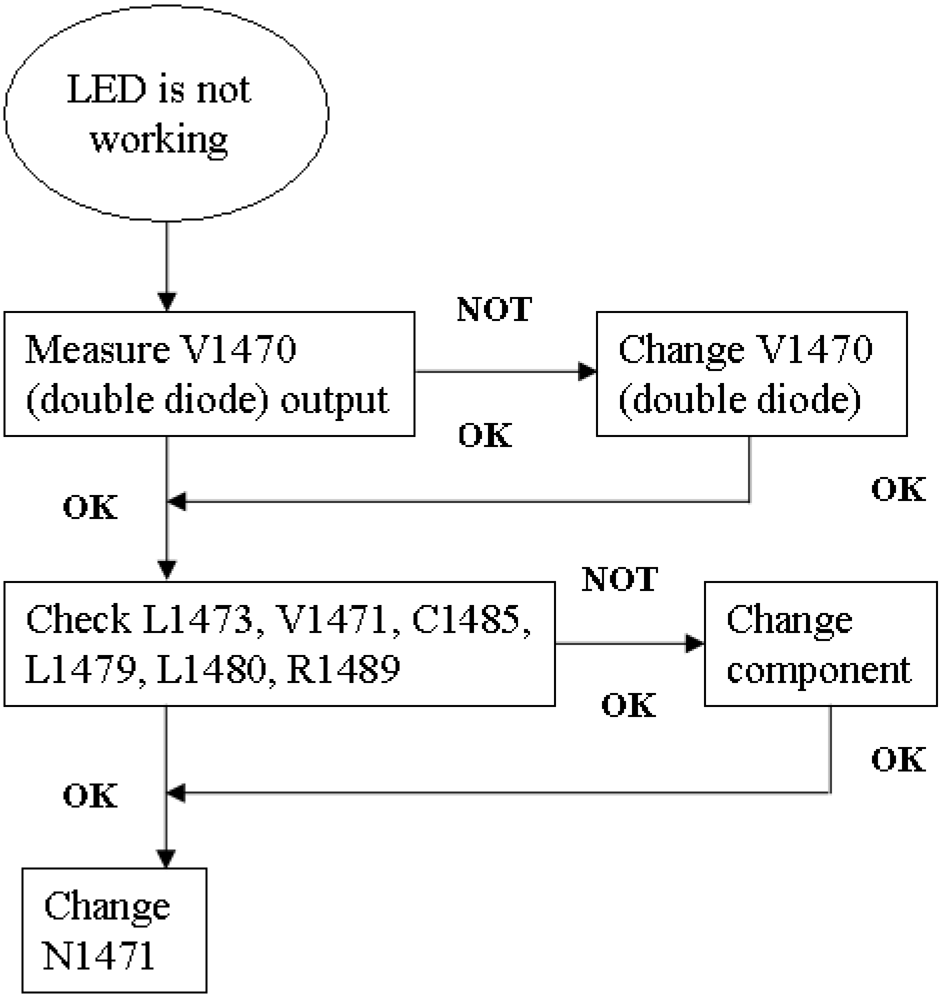
Flash LED indicator mode troubleshooting

For checking the indicator mode functionality, force the camera to record a video clip and monitor the flash led at the same time. The flash LED should work with very low brightness constantly during the video recording.


Indicator mode is not working
Measure V1470 (double diode) output
NOT
OK
Measure indicator mode Control from APE
OK
Change V1470 (double diode)
OK
See HW fault finding tree
NOT OK
Check OMAP 1710 troubleshooting

Flash LED HW baseband troubleshooting

If there are problems in the flash LED driver circuit, the testing procedure is complicated, because the driver circuit output cannot be reliably measured without the load (LED). Load (LED) is always disconnected from the output when the phone is disassembled.


LED is not working
Measure V1470 (double diode) output
NOT
OK
Change V1470 (double diode)
OK
OK
Check L1473, V1471, C1485, L1479, L1480, R1489
NOT
OK
Change component
OK
OK
Change N1471

9 — System Module

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Baseband description

System module block diagram

The device consists of two different main modules: transceiver (1lf) and UI (1hv). The transceiver board consists of baseband and RF components

The UI board consists of key domes and keypad backlights. Connection between the UI and the transceiver board is established via a board-to-board spring connector.

> **Note:** In this description, user interface HW covers display, camera, keyboard, keyboard backlight and ALS.

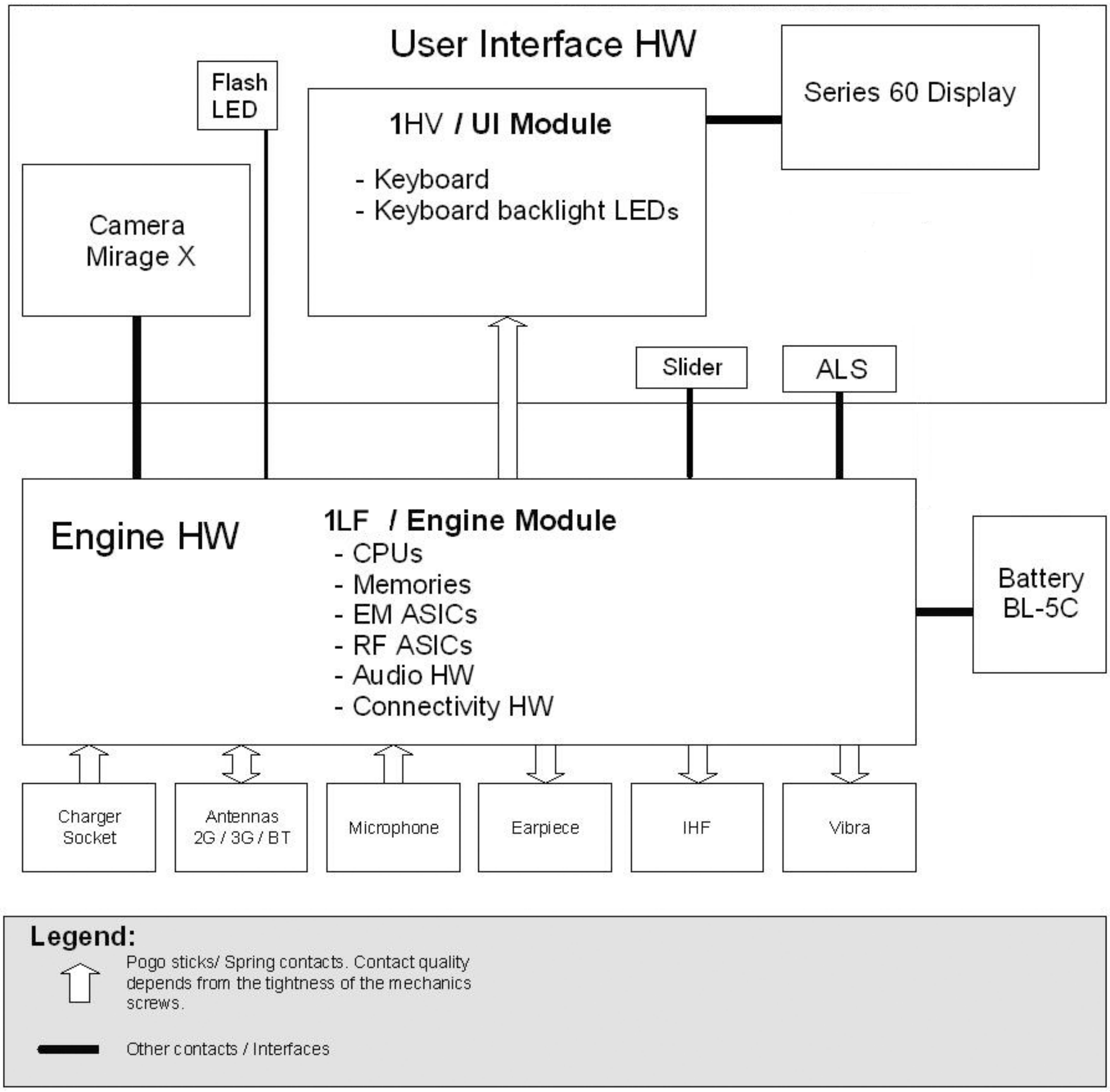

User Interface HW
Flash LED
1HV / UI Module
- Keyboard
- Keyboard backlight LEDs
Series 60 Display
Camera Mirage X
Slider
ALS
Engine HW
1LF / Engine Module
- CPUs
- Memories
- EM ASICs
- RF ASICs
- Audio HW
- Connectivity HW
Battery BL-5C
Charger Socket
Antennas 2G / 3G / BT
Microphone
Earpiece
IHF
Vibra
Legend:
Pogo sticks/ Spring contacts. Contact quality depends from the tightness of the mechanics screws.
Other contacts / Interfaces

Figure 92 System level block diagram

Baseband functional description

Digital baseband consists of ISA based modem and SYMBIAN based application sections. Modem functionality is in RAP3G and OMAP acts as a platform for SYMBIAN applications.

Modem section consists of RAP3G ASIC with NOR FLASH and SDRAM memory as the core. RAP3G supports cellular protocols of WCDMA (3GPP R-4) and GSM (minimum EDGE glass 10, GPRS phase2). Modem SDRAM memory have 64Mbits of memory and NOR flash have 64Mbits of memory. RAP3G operates with the system clock of 38.4 MHz, which comes from the VCTCXO.

Application section includes Helen3 ASIC with DDR/NAND combo memory as the core. Stacked DDR/NAND application memory has 256Mbits of DDR memory and 256Mbits of flash memory. OMAP uses 19.2MHz clock, which comes from the RAP3G divided by two from the 38.4 MHz system clock.

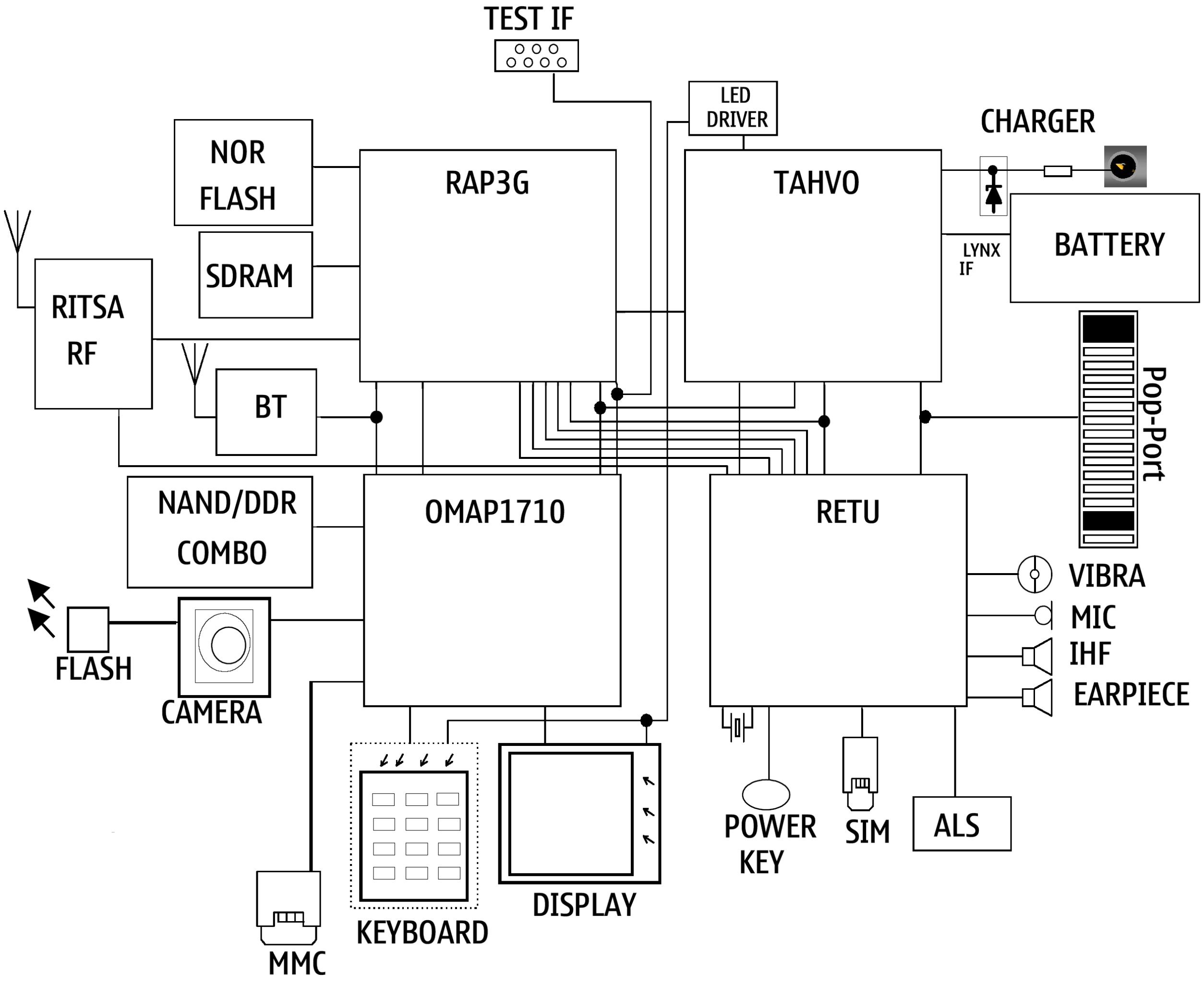

TEST IF
LED DRIVER
CHARGER
NOR FLASH
RAP3G
TAHVO
SDRAM
BATTERY
LYNX IF
RITSA RF
BT
Pop-Port
NAND/DDR COMBO
OMAP1710
RETU
VIBRA
MIC
IHF
EARPIECE
FLASH
CAMERA
POWER KEY
SIM
ALS
DISPLAY
KEYBOARD
MMC

Figure 93 Functional block diagram

OMAP processor (OMAP1710) is also called as an application ASIC because it is processing application SW and handles the UI SW. It consists of OMAP3.3 and peripheral subsystems like camera, display and keyboard driver blocks.

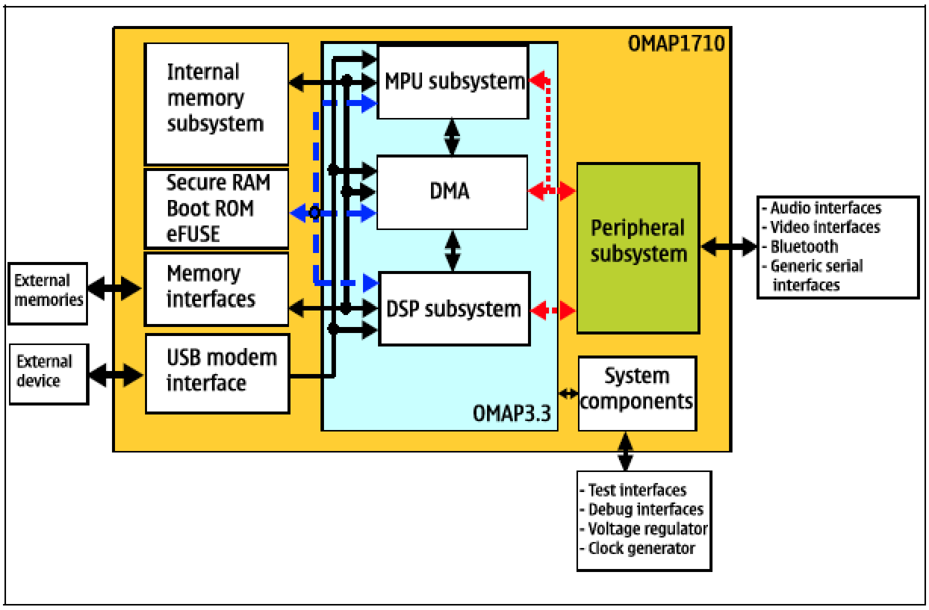

OMAP1710
Internal memory subsystem
MPU subsystem
Secure RAM
Boot ROM
eFUSE
DMA
Peripheral subsystem
- Audio interfaces
- Video interfaces
- Bluetooth
- Generic serial interfaces
External memories
Memory interfaces
DSP subsystem
External device
USB modem interface
System components
OMAP3.3
- Test interfaces
- Debug interfaces
- Voltage regulator
- Clock generator

Figure 94 Helen3 high level block diagram

OMAP3.3 consists of ARM926 (MPU subsystem), TMS320C55x (DSP subsystem), DMA and OMAP3.3s internal peripherals.

Helen3s MPU subsystem is based on an ARM926EJ. MPU is able to perform most of the application operations on the chip.

System DMA: This component is mainly used to help the MPU and DSP perform data memory transfer-specific tasks, leaving more available MIPS for both processors.

The DSP subsystem is based on a TMS320C55x™ DSP core, which is responsible for intensive data computing tasks like real-time audio and video handling on application side. E.g. voice recording.

Internal memory subsystem: This subsystem is composed of a single port SRAM.

Secure modules: OMAP1710 contains a set of several components, including ROM, a single port SRAM, and eFUSE cells. These components enable the system to support secure applications.

Memory interfaces: The memory interfaces define the system memory access organization of OMAP1710.

USB & modem interface: These two modules enable the platform to support a universal serial link and a dedicated modem interface, enabling a high data transfer rate between the modem and the application chip.

System components: System components are group of modules responsible for managing system interactions such as interrupt, clock control and idle.

Peripheral subsystem: The peripheral subsystem defines all the components used to interface OMAP1710 with specific external devices such as camera, keyboard, display etc.

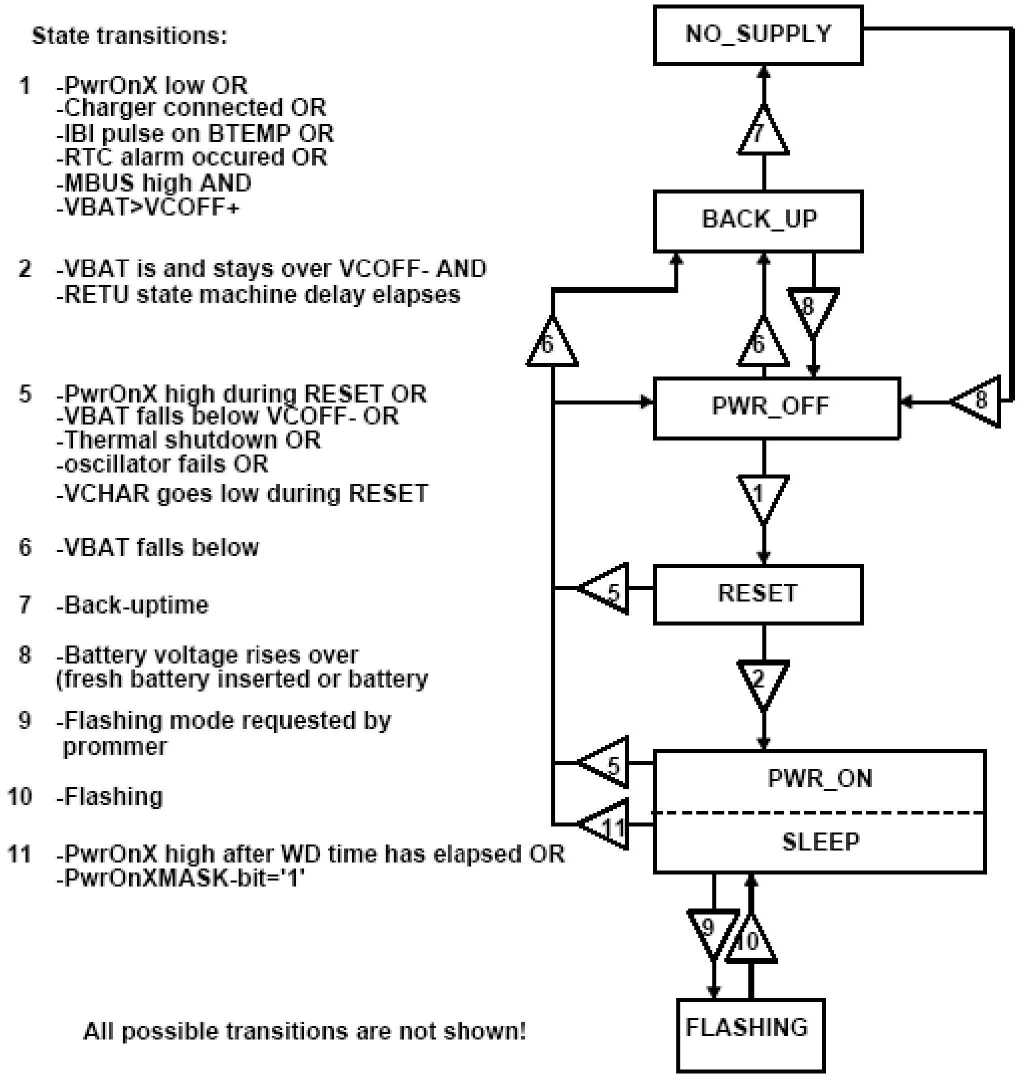
Absolute maximum ratings

Signal	Min	Nom	Max	Unit	Notes
Battery voltage (idle)	-0.3		+4.5	V	Battery voltage maximum value is specified during charging is active
Battery voltage (Call)			+4.3	V	Battery voltage maximum value is specified during charging is active
Charger input voltage	-0.3		+16V	V	

Signal	Min	Nom	Max	Unit	Notes
Back-Up supply voltage	0	2.5	2.7	V	Maximum capacity of the backup power supply assumed to be 200 µAh.

Modes of operation

Mode	Description
NO_SUPPLY	(dead) mode means that the main battery is not present or its voltage is too low (below RETU master reset threshold) and that the back-up battery voltage is too low.
BACK_UP	The main battery is not present or its voltage is too low but back-up battery voltage is adequate and the 32kHz oscillator is running (RTC is on).
PWR_OFF	In this mode (warm), the main battery is present and its voltage is over RETU master reset threshold. All regulators are disabled, PurX is on low state, the RTC is on and the oscillator is on. PWR_OFF (cold) mode is almost the same as PWR_OFF (warm), but the RTC and the oscillator are off.
RESET	RESET mode is a synonym for start-up sequence. In this mode certain regulators are enabled and after they and RFClk have stabilized, the system reset (PurX) is released and PWR_ON mode entered. RESET mode uses 32kHz clock to count the REST mode delay (typically 16ms).
SLEEP	SLEEP mode is entered only from PWR_ON mode with the aid of SW when the system's activity is low. There are in principle three different sleep modes: • Helen3 sleep • RAP3G sleep • OMAP and RAP3G sleep (deep sleep) In SLEEP mode RETU's regulators VIO, VDRAM, VSIM1, VSIM2, VAUX and Vana are in low quiescent current mode (output voltages still present but regulators will not give as much current out). Other regulators including VR1 supplying system clock oscillator are disabled. In SLEEP mode, TAHVO VCORE SMPS regulator is in low quiescent current mode (if sleep mode is not internally disabled). Linear regulator VOUT state depends on the accessory connected to the system connector (Pop-Port), if there is any.
FLASHING	FLASHING mode is for SW downloading. FLASHING mode is not really a RETU or TAHVO state but rather a system state. From RETU and TAHVO point of view, it is like PWR_ON. The state is entered from PWR_ON. It is possible to use external voltage (VPP) during flashing to speed up the process (provided that the memory components support the feature).



State transitions:

1 -PwrOnX low OR
-Charger connected OR
-IBI pulse on BTEMP OR
-RTC alarm occured OR
-MBUS high AND
-VBAT>VCOFF+

2 -VBAT is and stays over VCOFF- AND
-RETU state machine delay elapses

5 -PwrOnX high during RESET OR
-VBAT falls below VCOFF- OR
-Thermal shutdown OR
-oscillator fails OR
-VCHAR goes low during RESET

6 -VBAT falls below

7 -Back-uptime

8 -Battery voltage rises over
(fresh battery inserted or battery

9 -Flashing mode requested by
prommer

10 -Flashing

11 -PwrOnX high after WD time has elapsed OR
-PwrOnXMASK-bit='1'

All possible transitions are not shown!

Figure 95 State diagram

Voltage limits

Parameter	Description	Value
VMSTR	Master reset threshold (RETU)	2.2V (typ.)
VMSTR+	Threshold for charging, rising (TAHVO)	2.1V (typ.)
VMSTR-	Threshold for charging, falling (TAHVO)	1.9V (typ.)
VCOFF+	Hardware cutoff (rising)	2.9V (typ.)
VCOFF-	Hardware cutoff (falling)	2.6V (typ.)
SWCOFF	SW cutoff limit	~3.2V

The master reset threshold controls the internal reset of Retu / (Tahvo). If battery voltage is above VMSTR, Tahvo’s charging control logic is alive. Also, RTC is active and supplied from the main battery. Above VMSTR, Tahvo allows the system to be powered on although this may not succeed due to voltage drops during start up. SW can also consider battery voltage too low for operation and power down the system.

Power key

The system boots up when power key is pressed (adequate battery voltage, VBAT, present).

Power down can be initiated by pressing the power key again (the system is powered down with the aid of SW). Power on key is connected to Retu ASIC via PWRONX signal.

Power distribution

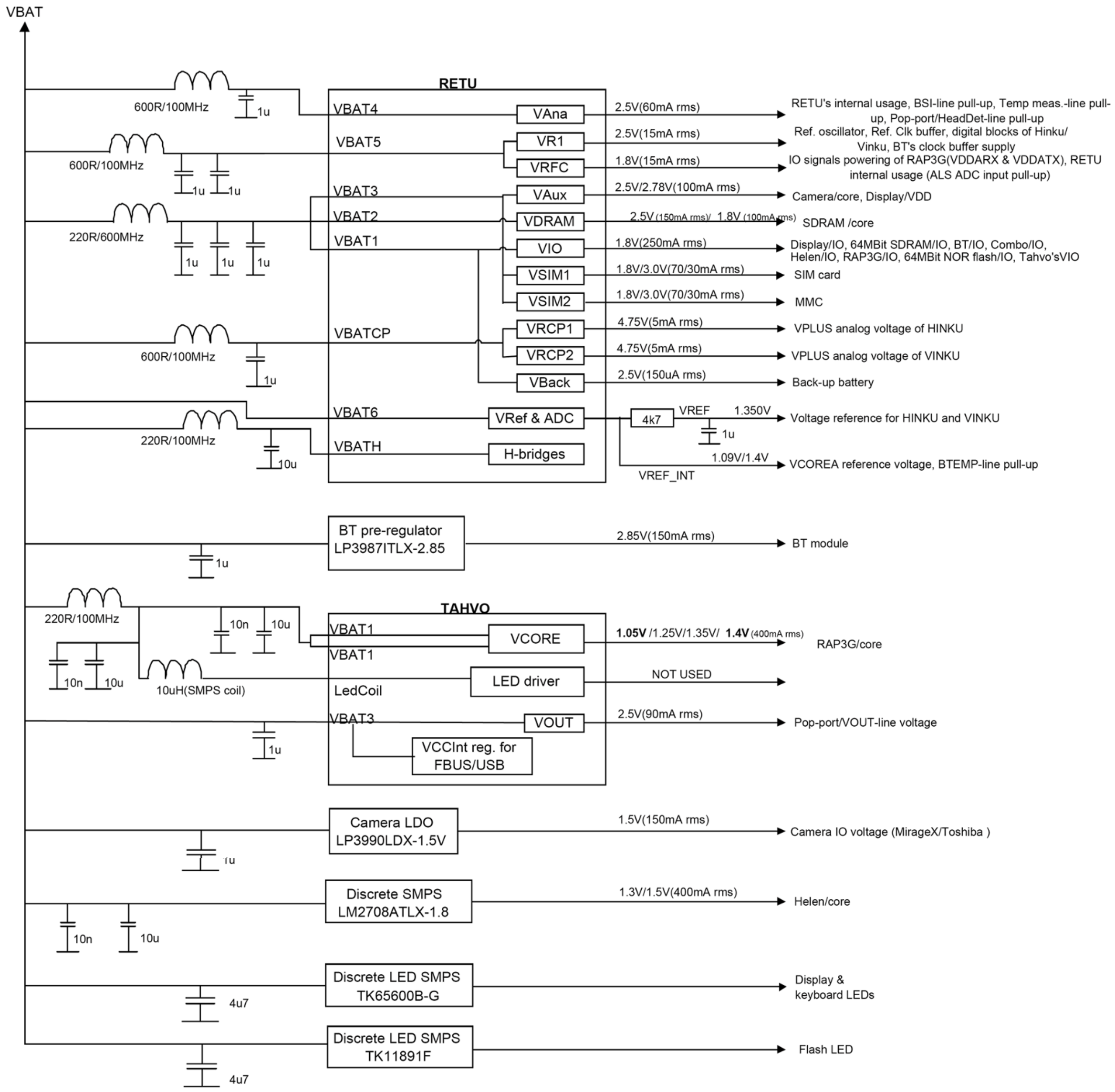

VBAT
600R/100MHz
1u
RETU
VBAT4
VAna
2.5V(60mA rms)
RETU's internal usage, BSI-line pull-up, Temp meas.-line pull-up, Pop-port/HeadDet-line pull-up
VBAT5
VR1
2.5V(15mA rms)
Ref. oscillator, Ref. Clk buffer, digital blocks of Hinku/ Vinku, BT's clock buffer supply
VRFC
1.8V(15mA rms)
IO signals powering of RAP3G(VDDARX & VDDATX), RETU internal usage (ALS ADC input pull-up)
600R/100MHz
1u
1u
VBAT3
VAux
2.5V/2.78V(100mA rms)
Camera/core, Display/VDD
220R/600MHz
VBAT2
VDRAM
2.5V (150mA rms)/ 1.8V (100mA rms)
SDRAM /core
VBAT1
VIO
1.8V(250mA rms)
Display/IO, 64MBit SDRAM/IO, BT/IO, Combo/IO, Helen/IO, RAP3G/IO, 64MBit NOR flash/IO, Tahvo'sVIO
1u
1u
1u
VSIM1
1.8V/3.0V(70/30mA rms)
SIM card
VSIM2
1.8V/3.0V(70/30mA rms)
MMC
VRCP1
4.75V(5mA rms)
VPLUS analog voltage of HINKU
600R/100MHz
VBATCP
1u
VRCP2
4.75V(5mA rms)
VPLUS analog voltage of VINKU
VBack
2.5V(150uA rms)
Back-up battery
VBAT6
220R/100MHz
VRef & ADC
4k7
VREF
1.350V
1u
Voltage reference for HINKU and VINKU
VBATH
10u
H-bridges
1.09V/1.4V
VREF_INT
VCOREA reference voltage, BTEMP-line pull-up
BT pre-regulator
LP3987ITLX-2.85
2.85V(150mA rms)
BT module
1u
220R/100MHz
TAHVO
10n
10u
VBAT1
VCORE
1.05V /1.25V/1.35V/ 1.4V (400mA rms)
RAP3G/core
VBAT1
10n
10u
10uH(SMPS coil)
LedCoil
LED driver
NOT USED
VBAT3
VOUT
2.5V(90mA rms)
Pop-port/VOUT-line voltage
1u
VCCInt reg. for FBUS/USB
Camera LDO
LP3990LDX-1.5V
1.5V(150mA rms)
Camera IO voltage (MirageX/Toshiba)
1u
Discrete SMPS
LM2708ATLX-1.8
1.3V/1.5V(400mA rms)
Helen/core
10n
10u
Discrete LED SMPS
TK65600B-G
4u7
Display &
keyboard LEDs
Discrete LED SMPS
TK11891F
4u7
Flash LED

Figure 96 Power distribution diagram

Power supply components:

- RETU
- TAHVO
- OMAP VCORE SMPS

- BT
- LDO
- camera LDO
- backlight SMPS

All the above are powered by the main battery voltage.

Battery voltage is also used on the RF side for power amplifiers (GSM PA & WCDMA PA) and for RF ASICs Hinku (Rx) & Vinku(Tx).

Discrete power supplies are used to generate 2.8V to BT, 1.5V for the camera IO voltage, 2.8V for the front camera IO voltage, 1.3V/1.5V for Helen 3 and 18V for the backlight LEDs.

The device supports both 1.8V/3V SIM cards which are powered by RETU / VSIM1. RETUs VSIM2 is used to power RS MMC 1.8V only. USB accessories which needs power from the device are powered by TAHVO / VOUT.

Because LED driver in TAHVO is not used, the external SMPS is used instead. External LED SMPS is still controlled by TAHVO and powered by battery voltage.

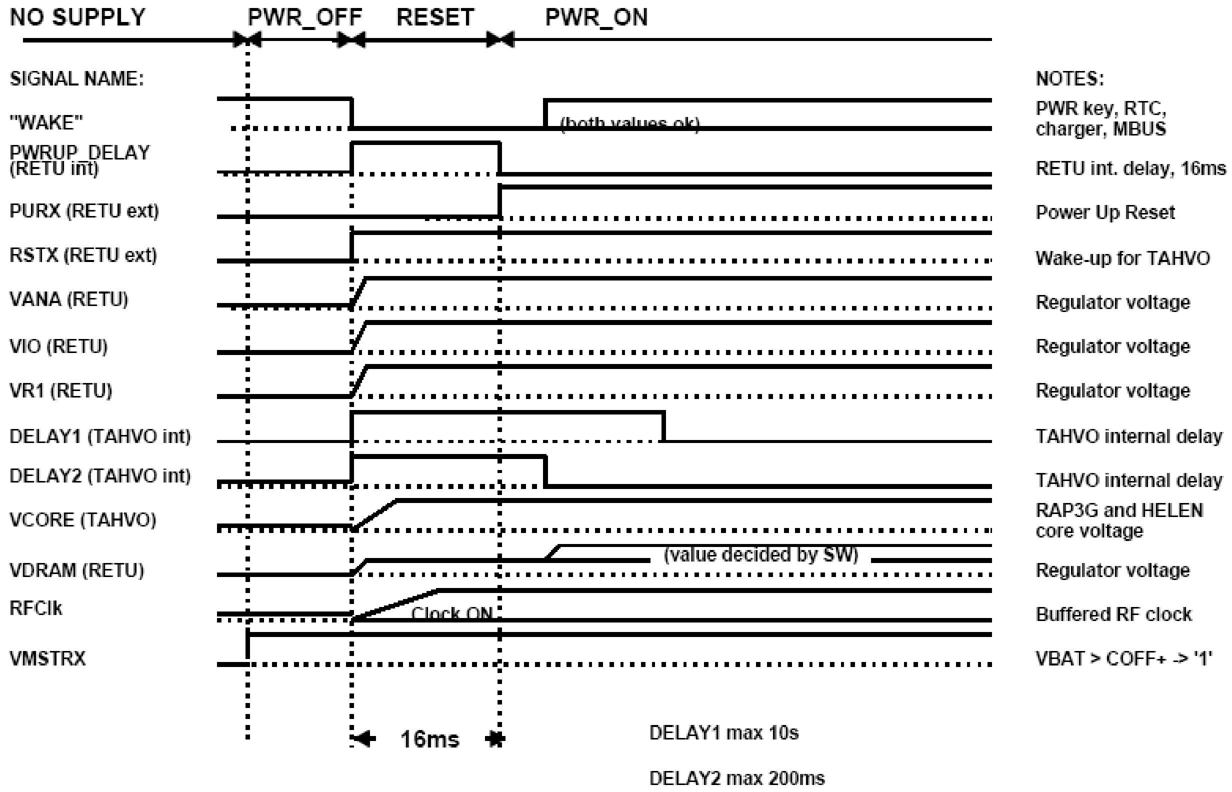
System power-up

After inserting the main battery, regulators started by HW are enabled. SW checks, if there is some reason to keep the power on. If not, the system is set to power off state by watchdog. Power up can be caused by the following reasons:

- Power key is pressed
- Charger is connected
- RTC alarm occurs
- MBUS wake-up

After that:

- Retu activates sleep clock and VANA, VDRAM, VIO and VR1 regulators.
- Voltage appearing at Retu's RSTX pin is used for enabling Tahvo ASIC.
- Tahvo enables VCORE regulator and its internal RC-oscillator (600kHz).
- VCTCXO regulator is set ON and RF clock (main system clock) is started to produce.
- Retu will release PURX ~ 16ms after power up is enabled (the RF clock is then stable enough).
- Synchronizing clock (2.4MHz) for Tahvo is started to be produced. After PURX is released and two rising edges of 2.4MHz synchronous clock have been detected in SMPSClk input Tahvo is starting to use that instead of 600kHz internal RC-oscillator.
- HW start-up procedure has been finalized and the system is up and running. Now it is possible for SW to switch ON other needed regulators.


NO SUPPLY
PWR_OFF
RESET
PWR_ON
SIGNAL NAME:
"WAKE"
PWRUP_DELAY (RETU int)
PURX (RETU ext)
RSTX (RETU ext)
VANA (RETU)
VIO (RETU)
VR1 (RETU)
DELAY1 (TAHVO int)
DELAY2 (TAHVO int)
VCORE (TAHVO)
VDRAM (RETU)
RFClk
VMSTRX
(both values ok)
(value decided by SW)
Clock ON
16ms
DELAY1 max 10s
DELAY2 max 200ms
NOTES:
PWR key, RTC, charger, MBUS
RETU int. delay, 16ms
Power Up Reset
Wake-up for TAHVO
Regulator voltage
Regulator voltage
Regulator voltage
TAHVO internal delay
TAHVO internal delay
RAP3G and HELEN core voltage
Regulator voltage
Buffered RF clock
VBAT > COFF+ -> '1'

DELAY1 is started to count from charger detection or detecting '1' in RSTX.
DELAY2 is started to count when '1' is detected in RSTX.
VDRAM is powered up to 1.8V at start and after SW starts, the decision whether to use 1.8V or 2.5V is done.

Figure 97 System start-up timing

Clocking scheme

In BB5.0, two main clocks are provided to the system: 38.4MHz RF clock produced by VCTCXO in RF section and 32.768kHz sleep clock produced by RETU with an external crystal.

RF clock is generated only when VCTCXO is powered on by RETU regulator. Regulator itself is activated by SleepX signals from both RAP3G and Helen3. When both CPUs are on sleep, RF clock is stopped.

RF clock is used by RAP3G that then provides (divided) 19.2MHz SysClk further to OMAP. Both RAPG and Helen3 have internal PLLs which then create clock signals for other peripheral devices/interfaces like RS MMC, SIM, CCP, I2C and memories.

32k Sleep Clock is always powered on after startup. Sleep clock is used by RAP3G and OMAP for low-power operation.

SMPS Clk is 2.4MHz clock line from RAP3G to Tahvo used for switch mode regulator synchronizing in active mode. In deep sleep mode, when VCTCXO is off, this signal is set to '0'-state.

BT Clk is 38.4MHz signal from Hinku ASIC to BT module.

CLK600 is 600KHz signal from Tahvo to APE VCORE SMPS. The clock source is internal RC oscillator in Tahvo (during the power-up sequence) or RAP3G SMPS Clk divided by 4 after the power-up sequence.

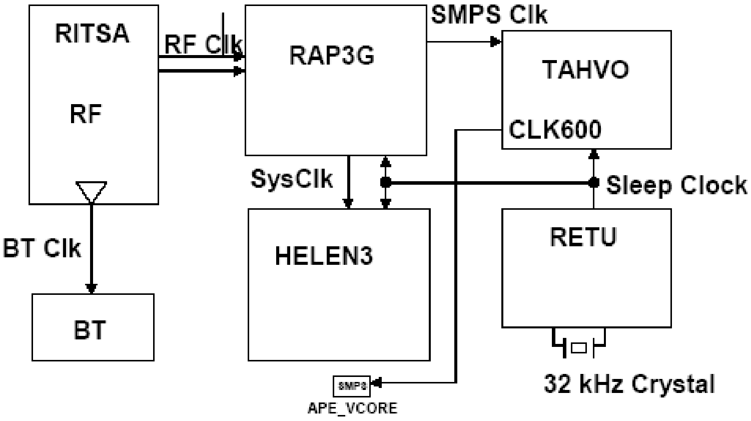


Figure 98 Clocking scheme

Bluetooth

Bluetooth provides a fully digital link for communication between a master unit and one or more slave units. The system provides a radio link that offers a high degree of flexibility to support various applications and product scenarios. Data and control interface for a low power RF module is provided. Data rate is regulated between the master and the slave.

The device Bluetooth is based on CSR's BC3 BT ASIC.

The UART1 interface handles the transfer of control and data information between OMAP and the BT system (BC3).

The PCM interface is used for audio data transfer between RAP3G and the BT system (BC3).

USB

USB (Universal Serial Bus) provides a wired connectivity between host PC and peripheral devices.

USB is a differential serial bus for USB devices. USB controller (RAP3G) supports USB specification revision 2.0 with full speed USB (12Mbps). The device is connected to the USB host through the Pop-Port^{TM} connector. The USB bus is hot plugged capable, which means that USB devices may be plugged in/out at any time.

See Also

- USB interface electrical characteristics (Page 9–30)

SIM interface

The device has one SIM (Subscriber Identification Module) interface and the SIM card location is under the battery. SIM interface consists of internal interface between RAP3G and Retu and an external interface between Retu and SIM contacts. SIM interface functionality is located in RAP3G while Retu takes care of power up/down, card detection, ATR counting and level shifting. For Retu external SIM IF connections, see SIM interface connections (Page 9–32).

The SIM IF is shown in the following figure:

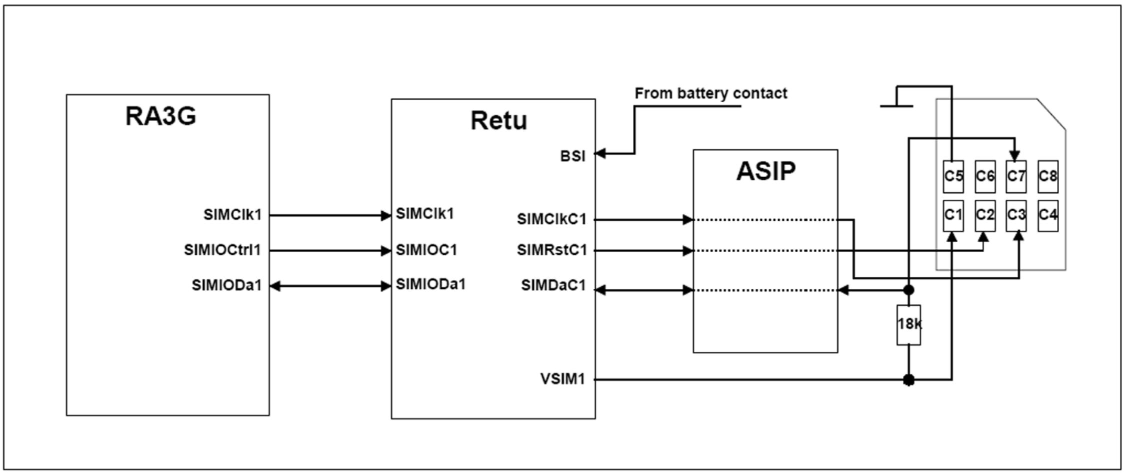

RA3G
SIMClk1
SIMIOCtrl1
SIMIODa1
Retu
BSI
SIMClk1
SIMIOC1
SIMIODa1
SIMClkC1
SIMRstC1
SIMDaC1
VSIM1
From battery contact
ASIP
C5
C6
C7
C8
C1
C2
C3
C4
18k

Figure 99 SIM interface

Retu handles SIM card detection and the detection method is based on the BSI line. Due to location of the SIM card removal of the battery causes quick power down of the SIM IF. The Retu SIM1 interface supports both the 1.8V and 3.0V SIM cards. SIM interface voltage is first 1.8V when the SIM card is inserted and if the card does not response to the ATR (Answer To Reset) 3V interface voltage is used. The data communication between the card and the phone is asynchronous half duplex and the clock supplied to cards is 1-5MHz, which is 3.2MHz by default (in GSM system). The data baud rate is SIM card clock frequency divided by 372 (by default), 64, 32 or 16.

RS MMC interface

The reduced size (24mm x 18mm x 1.4mm) multimedia card slot is located under the battery. The device supports RS MMC hot insertion so it is possible to remove/insert the card when the phone is powered on.

RS MMC card is connected to the Helen3 processor MMC/SDIO2 (1.8V) interface. MMC interface is shown in the following figure:

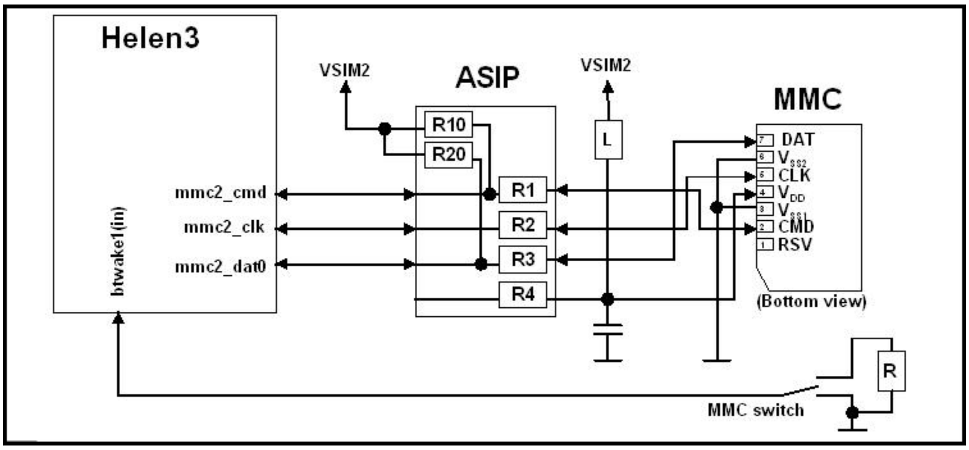

Helen3
btwake1(in)
mmc2_cmd
mmc2_clk
mmc2_dat0
VSIM2
ASIP
R10
R20
R1
R2
R3
R4
VSIM2
L
MMC
7 DAT
6 V_{SS2}
5 CLK
4 V_{DD}
3 V_{SS1}
2 CMD
1 RSV
(Bottom view)
R
MMC switch

Figure 100 MMC interface

The basic multimedia card concept is based on the following communication signals CLK, CMD and DAT. With each cycle of the CLK signal one bit transfer on the DAT and CMD line is done. The maximum CLK frequency is 20MHz (specified in multimedia card specification). Maximum used CLK frequency at the time is 16MHz. CMD is a bi-directional command channel used for card initialization and data transfer commands. CMD signal has two operational modes open-drain and push-pull mode. Open-drain mode is used for card initialization and push-pull mode for fast command transfer. CMD commands are sent by the host and CMD responses are sent by the card. DAT is a bi-directional data channel, which operates at push-pull mode.

The detection of RS MMC card removal/insertion is done via RS MMC cover switch. Removing RS MMC while writing to RS MMC may corrupt data in RS MMC. RS MMC cover switch gives an interrupt to the SW while the cover is opened or closed. After RS MMC cover lid opening (RS MMC SW signal is connected to GND via cover switch) the SW power down the RS MMC card and switches off the RS MMC power supply (VSIM2). When the RS MMC cover lid is closed (RS MMC SW signal is internally connected in Helen3 to 1.8V) the card should be identified if card exists.

See Also

- RS MMC interface connections (Page 9–32)

Battery interface

The battery interface supports NMP Lynx battery interface for the BL-5C battery. This interface consists of three connectors: VBAT, BSI and GND. BSI line is used to recognize battery capacity by a battery internal pull down resistor.

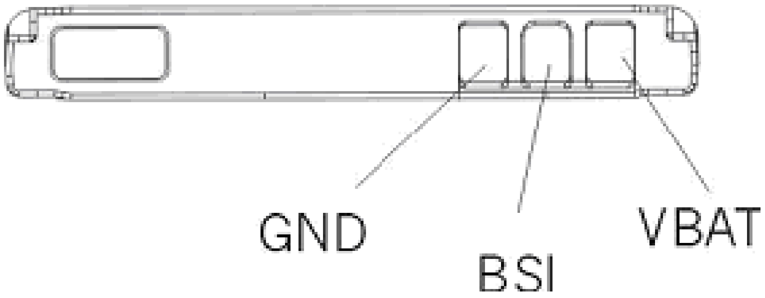


Figure 101 Battery pin order

Battery temperature is estimated by measuring separate battery temperature NTC via BTEMP line, which is located on the transceiver PWB, in a place where phone temperature is most stabile.

For service purposes the device SW can be forced into local mode by using pull down resistors connected to the BSI line.

See Also

- Battery connector and interface connections & electrical characteristics (Page 9–34)

Camera interface

The device uses a Mirage- X camera module. Mirage-X is a 1.3Mpixel camera with sensor resolution of 1280 x 960. The following figure shows the block diagram where CCP bus is used to transfer image data from camera to engine. Bi-directional control bus is an SW implemented I2C interface.

Camera regulator N1470 powers digital parts of camera. VAUX power rail is for powering analogue parts of the camera.

CAMVCTRL signal (Vctrl) is used for activating the camera module. When Vctrl is turned on High level , the camera module enters the operation mode. When Vctrl is turned on Low level, the camera module enters the power off mode.

CAMCLK signal feeds system clock for camera module.

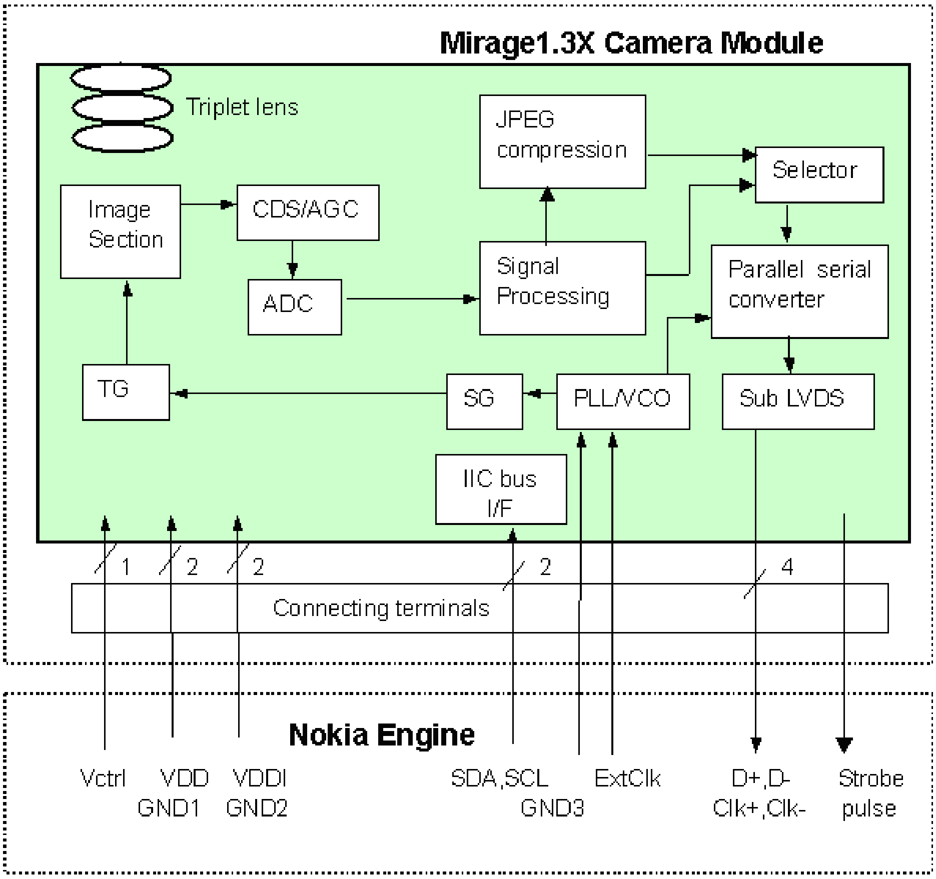

Mirage1.3X Camera Module
Triplet lens
JPEG compression
Selector
Image Section
CDS/AGC
Signal Processing
Parallel serial converter
ADC
TG
SG
PLL/VCO
Sub LVDS
IIC bus I/F
1
2
2
2
4
Connecting terminals
Nokia Engine
Vctrl
VDD GND1
VDDI GND2
SDA,SCL GND3
ExtClk
D+,D- Clk+,Clk-
Strobe pulse

Figure 102 Block diagram of Mirage-X camera module

Back camera slider detection switch

The back camera and flash LED have a cover slider, which position is detected with a slider switch (slider sensor).

When the slider covers the back camera and flash LED (upper position), the slider switch is open circuit (not pressed) and the OMAP1710 is connected to VIO. When the slider is slid down, the switch is pressed and it connects the Helen pin mcbsp1_sync to GND (typical 160mV) and activates the back camera application

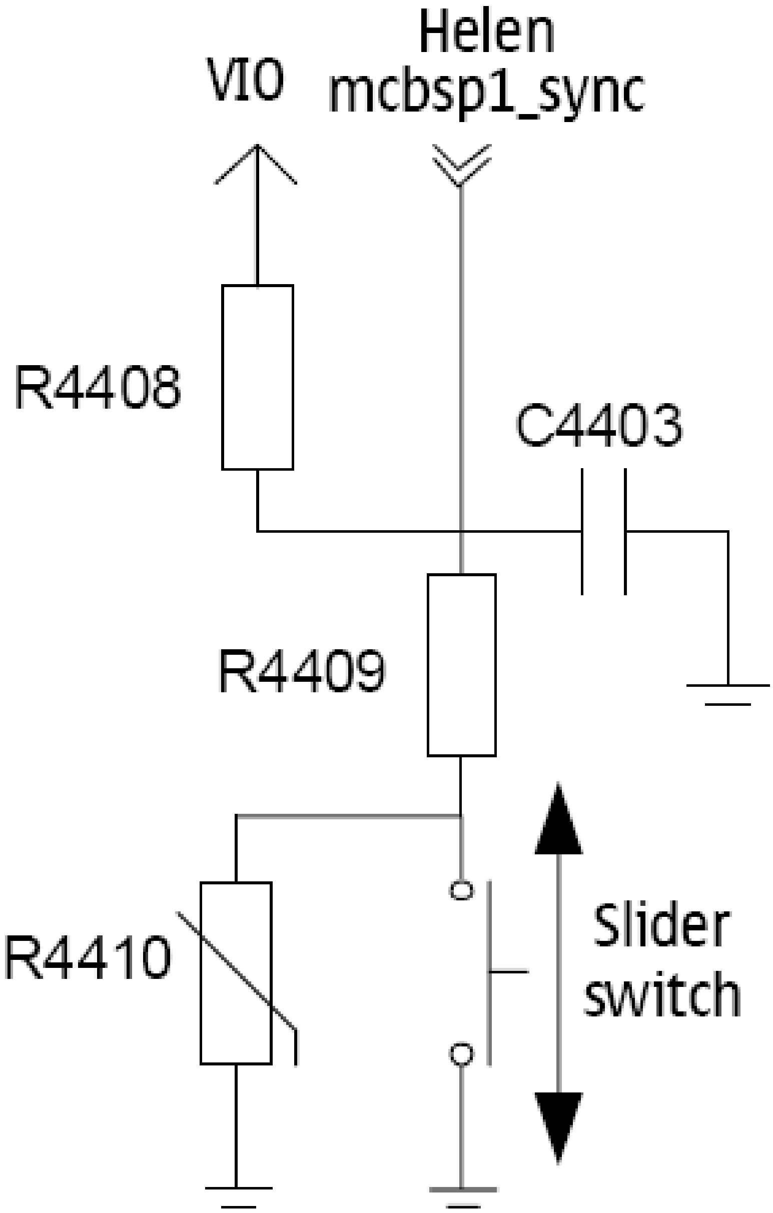


Figure 103 Slider switch connection

Flash LED

The device back camera includes a flash LED (FLED) providing better lighting conditions in darker environments. The same LED is also used as an indicator light for indicating when a video clip is being recorded.

The FLED is located beside the back camera under the camera slide. It cannot be used when the slide is closed and it is only used when the back camera is in the still image mode or as an indicator for video recording or image capturing. The operating range of FLED is approximately 1 m (~22 Lux) and 1.5 m (~9 Lux).

The connections between the main PWB and the FLED is implemented with a small PWB attached to the device mechanics.

The FLED has four white LEDs connected in series in one module. The module also includes a lens with its plastic housing. The dimensions of the FLED are 6.5 x 7.5 x 3.5 mm.

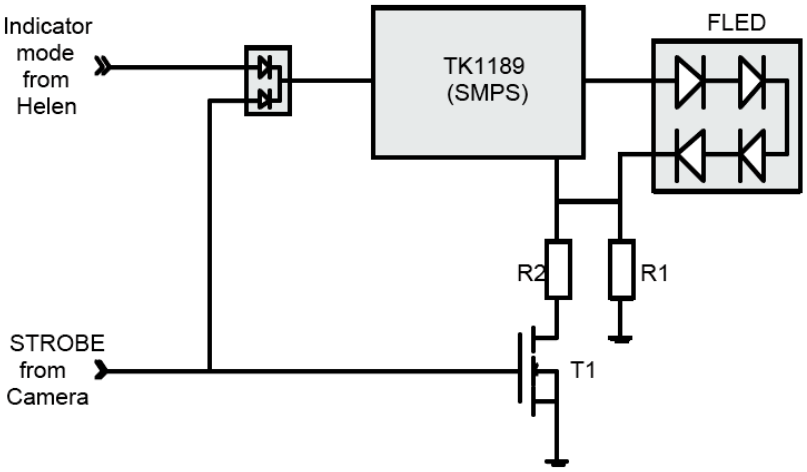

Indicator mode from Helen
TK1189 (SMPS)
FLED
R2
R1
STROBE from Camera
T1

Figure 104 Simplified flash LED connection

User interface

Display interface

Display module mechanical concept

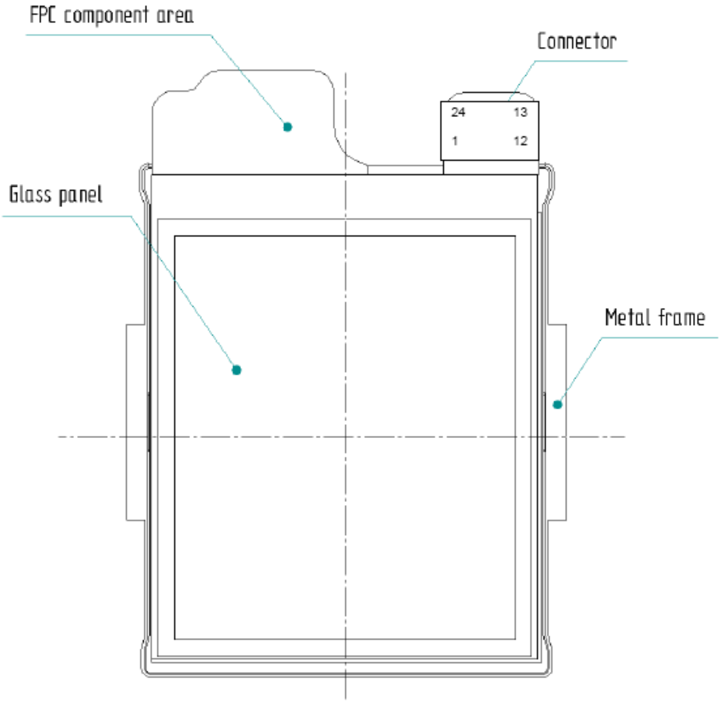

FPC component area
Connector
24
13
1
12
Glass panel
Metal frame

Figure 105 General diagram of the LCD module

Display features:

- 262,144 colours
- Partial display function Power saving by pausing display process on part of the screen.
- Built-in RAM capacity 176rows x 208lines x 18bits = 658,944 bits

The display has two different operating modes:

1 Normal mode, Full screen, 260k colours

2 Normal Partial mode, 260k colors but only part of the display is active

The module includes:

- FPWB foil including connector and discretes and driver circuits
- display panel (glass)
- drivers including display controller and 176 x 208 x 18 bits RAM
- backlight system: lightguide, LEDs and necessary optical sheets
- supporting mechanics
- metal frame (stainless steel)
- plastic frame

The interconnection between the LCD module and the Nokia engine is implemented with a 24-pin board-to-board connector.

Display is controlled via MeSSi-8 interface by Helen3. All MeSSi-8 signals go through the EMC filtering ASIPs.

The display module does not require any tunings in service.

Keyboard

The device keyboard is connected to the main PWB with a board-to-board connector.

The keymatrix has six rows and four columns. The voice key on the main PWB and the navigation key are connected to the same keymatrix.

Table 18 Keymatrix

	Col3	Col2	Col1	Col0
Row0	Right	Left	Right soft key	Left soft key
Row1	Down	Up	Send	Select
Row2	8	3	2	7
Row3	6	1		5
Row4	#		*	9
Row5	4		Voice	End
Row6	Apps	Clear	Edit	0

Display and keyboard backlight

The device has one Led Driver (SMPS) that is used to drive both display and keyboard LEDs.

Both display LEDs (4pcs) and keyboard LEDs (4pcs) are connected in series.

Current adjustment of the driver is done from the display LED branch, and keyboard current also depends on the display brightness.

In a typical use case, keyboard LEDs are turned ON only in dark ambient lighting conditions.

Control signals for LED driver are:

	From	To	Voltage	Function
GenOut1	TAHVO	R2302 (10k)	0V / 1.8V	Maximum current control (0V ->max curr.)
GenOut2	TAHVO	R2301 (4k7)	0V / 1.8V	

	From	To	Voltage	Function
PWM	TAHVO	J2309, N2301	PWM 0%-100%, 1.8V	Current PWM control (16 steps)
GenOut3	TAHVO	V2300	0V / 1.8V	Keyboard LEDs ON (1.8V) /OFF (0V)

ALS interface

Ambient Light Sensor (ALS) is located in the upper part of the phone. It consists of a lightguide (part of front cover), phototransistor (V4400)+ resistor (R4401), NTC + resistors (R4400, R4402, R4403) and RETU EM ASIC (N2200). Information of ambient lighting is used to control backlights of the phone:

- Keypad lighting is switched on only when environment is dark / dim
- Display backlights are dimmed, when environment is dark / dim

Ambient light sensor itself is a photo transistor which is temperature-compensated by an external NTC resistor. Retu with its ADC reads the light sensor (LS) and temperature (LST) results.

ALS calibration is not possible in the service points. It is replaced by using selected phototransistors as spare parts.

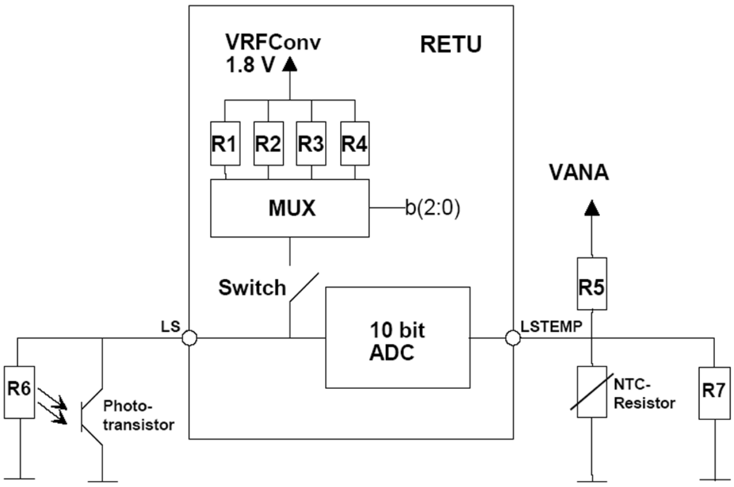


Figure 106 ALS HW implementation

Table 19 ALS resistor values

Symbol	R1	R2	R3	R4	R5	R6	R7	NTC-res
Value	5 kOhm	15 kOhm	30 kOhm	50 kOhm	470 kOhm	100 kohm	470 kohm	47 kOhm

ASICs

RAP3G ASIC

RAP3G ASIC is a 3G Radio Application Processor. RAM memory is integrated into RAP3G.

In general RAP3G consists of three separate parts:

- Processor subsystem (PSS) that includes the main processor and related functions
- MCU peripherals that are mainly controlled by MCU
- DSP peripherals that are mainly controlled by DSP

RAP3G core voltage (1.40V) is generated from Tahvo VCORE and I/O voltage (1.8V) is from Retu VIO. The core voltage in sleep mode is lowered to 1.05V.

Retu EM ASIC

Retu EM ASIC includes the following functional blocks:

- Start up logic and reset control
- Charger detection
- Battery voltage monitoring
- 32.768kHz clock with external crystal
- Real time clock with external backup battery
- SIM card interface
- Stereo audio codecs and amplifiers
- A/D converter
- Regulators
- Vibra interface
- Digital interface (CBUS)

Tahvo EM ASIC

Tahvo EM ASIC includes the. following functional blocks:

- Core supply generation
- Charge control circuitry
- Level shifter and regulator for USB/FBUS
- Current gauge for battery current measuring
- External LED driver control interface
- Digital interface (CBUS)

Device memories

RAP3G memories NOR flash and SDRAM

Modem memory consists of 64 Mbit SDRAM and 64 Mbit NOR flash memories.

SDRAM is a dynamic memory for ISA SW.

NOR is used for ISA SW code and PMM data and CDSP SW code.

16-bit wide SDRAM interface consists of DDR SDRAM controller from ARM, DCDL/DLLs and wrapper logic. 32-bit wide flash interface is implemented by using EMC module.

SDRAM core voltage (1.8V) is generated from Retu VDRAM and I/O voltage (1.8V) is from VIO. NOR flash uses VIO for both core and I/O voltages.

Combo memory

The application memory of the device consists of NAND/DDR combo memory. Stacked DDR/NAND application memory has 256 Mbit of DDR memory and 256 Mbit of flash memory. DDR DRAM memory is stacked above the NAND flash.

OMAP includes a 16-bit dedicated memory interface called external memory interface fast (EMIFF). This is used to support interface for DDR memory. OMAP1610 provides also NAND flash controller located on the shared peripheral bus, providing support for 8-bit NAND flash. The interface requires an 8-bit address bus multiplexed with 8-bit data bus and several control signals.

Core voltage for DDR is 1.8V, which is generated by discrete LDO (LP3999-1.8). 1.8V (VIO) is for DDR I/O voltage. Both NAND core and I/O voltages are 1.8V generated by VIO.

Audio concept

Audio HW architecture

The functional core of the audio hardware is built around two ASICs: RAP 3G CMT engine ASIC and the mixed-signal ASIC Retu.

Retu provides an interface for the transducers and the accessory connector. Because audio amplifiers are also integrated into Retu, the only discrete electronics components needed for audio paths are audio filtering components and EMC/ESD components.

There are three audio transducers:

- 8mm dynamic earpiece
- 16mm dynamic speaker
- electret microphone module

In addition to the audio transducers, Retu also provides an output for the dynamic vibra component.

All galvanic audio accessories are connected to the Pop-Port^{TM} accessory connector.

A Bluetooth audio module BC02 that is connected to RAP3G supports Bluetooth audio functionality.

There is a separate application ASIC, OMAP 1710, for Symbian applications.

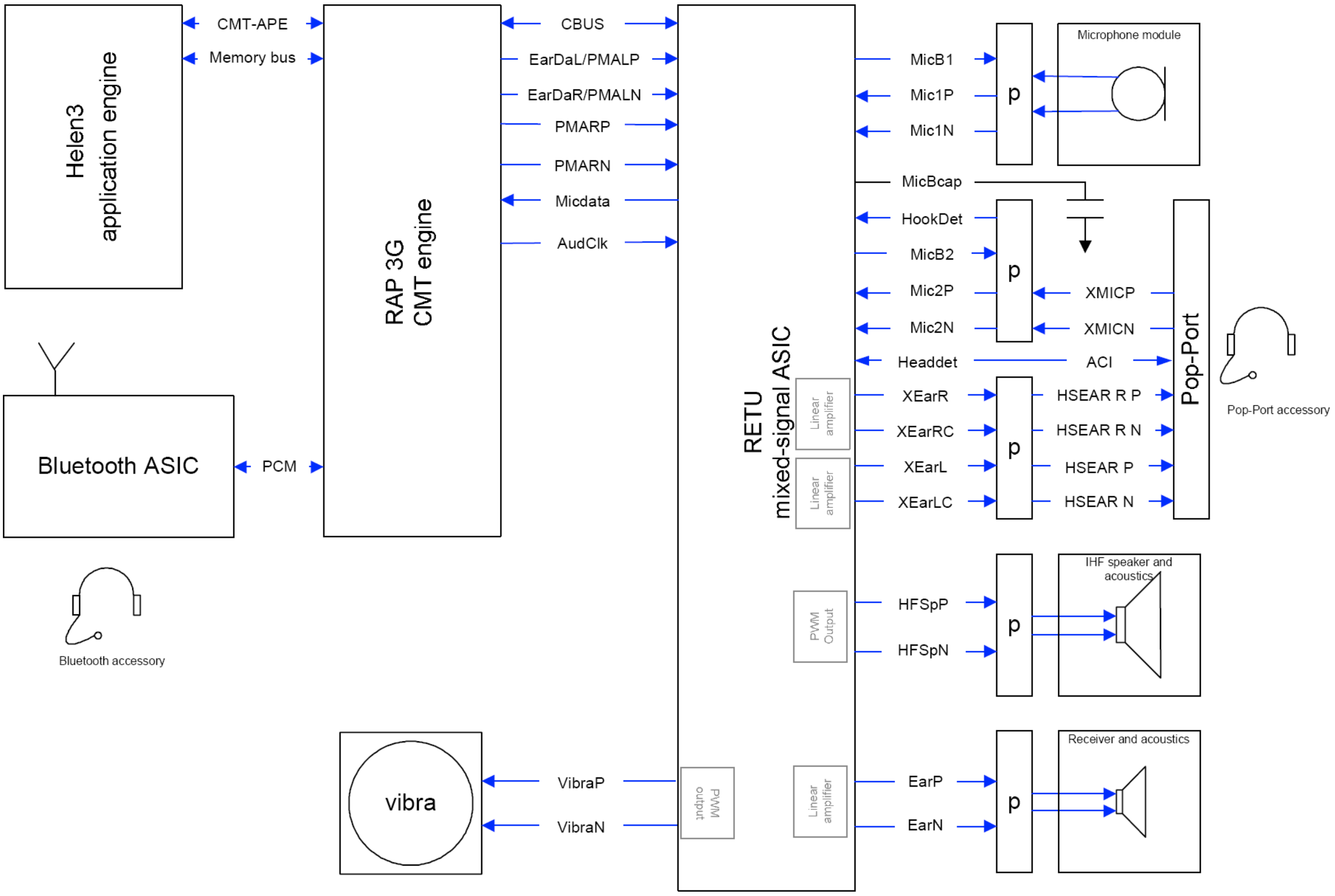

Helen3 application engine
CMT-APE
Memory bus
RAP 3G CMT engine
CBUS
EarDaL/PMALP
EarDaR/PMALN
PMARP
PMARN
Micdata
AudClk
Bluetooth ASIC
PCM
Bluetooth accessory
RETU mixed-signal ASIC
Linear amplifier
Linear amplifier
PWM Output
PWM output
Linear amplifier
MicB1
Mic1P
Mic1N
MicBcap
HookDet
MicB2
Mic2P
Mic2N
Headdet
XEarR
XEarRC
XEarL
XEarLC
HFSpP
HFSpN
EarP
EarN
p
p
p
p
p
Microphone module
XMICP
XMICN
ACI
HSEAR R P
HSEAR R N
HSEAR P
HSEAR N
Pop-Port
Pop-Port accessory
IHF speaker and acoustics
Receiver and acoustics
vibra
VibraP
VibraN

Figure 107 Audio block diagram

Internal microphone

Internal microphone is used for HandPortable (HP) and Internal HandsFree (IHF) call modes.

An analogue electret microphone is connected to Retu ASIC's Mic1P and Mic1N inputs via asymmetric electrical connection.

The microphone is biased by Retu ASIC MicB1 bias voltage output.

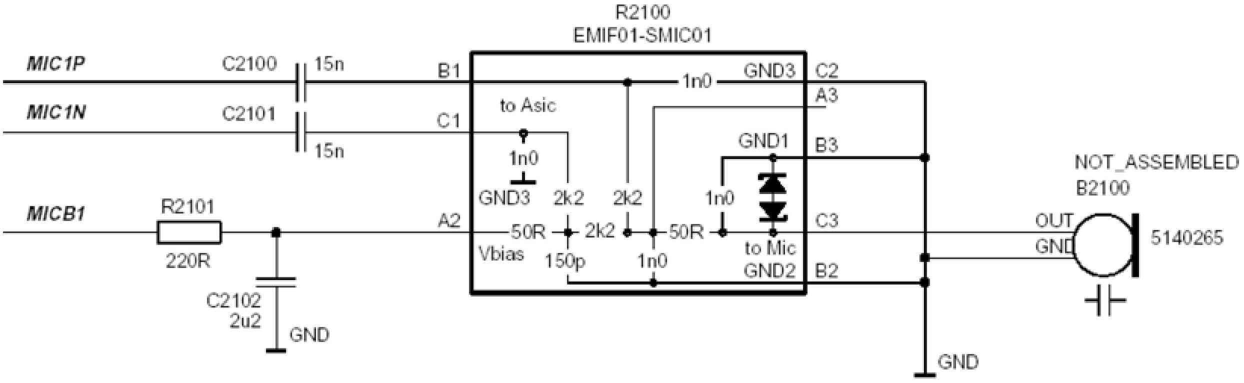

R2100
EMIF01-SMIC01
MIC1P
MIC1N
MICB1
C2100
15n
C2101
15n
R2101
220R
C2102
2u2
GND
B1
C1
A2
to Asic
1n0
GND3
2k2
2k2
50R
2k2
50R
Vbias
150p
1n0
1n0
GND3
GND1
1n0
to Mic
GND2
C2
A3
B3
C3
B2
NOT_ASSEMBLED
B2100
OUT
GND
5140265
GND

Figure 108 Internal microphone circuitry

External microphone

Galvanic accessories are connected to the system connector (Pop-Port^{TM}).

Accessory audio mode is automatically enabled/disabled during connection/disconnection of dedicated phone accessories.

External microphone circuitry is biased by Retu ASIC MicB2 bias voltage output. The circuitry provides a symmetrical connection for the microphone from the Pop-Port^{TM}connections, XMICN and XMICP, to Retu ASIC inputs, Mic2P and Mic2N.

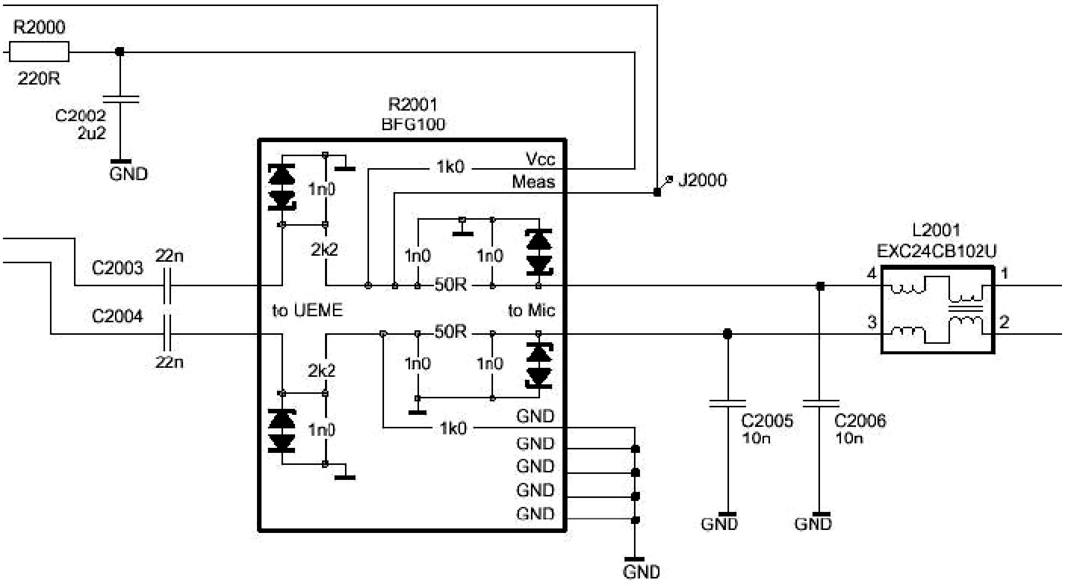

R2000
220R
C2002
2u2
GND
R2001
BFG100
C2003
22n
C2004
22n
1n0
2k2
to UEME
2k2
1n0
1k0
Vcc
Meas
1n0
1n0
50R
to Mic
50R
1n0
1n0
1k0
GND
GND
GND
GND
GND
GND
J2000
L2001
EXC24CB102U
4
1
3
2
C2005
10n
C2006
10n
GND
GND

Figure 109 External microphone circuitry (Pop-Port connects to the right side)

Internal earpiece

Internal earpiece is used for the HandPortable (HP) call mode. A dynamic 8mm earpiece capsule is connected to Retu ASIC's differential output EarP and EarN.

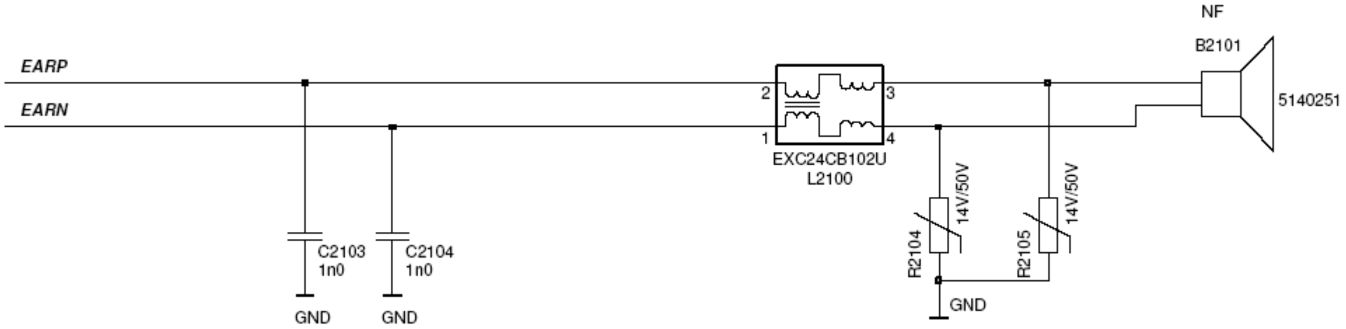

EARP
EARN
C2103
1n0
GND
C2104
1n0
GND
2
3
1
4
EXC24CB102U
L2100
R2104
14V/50V
GND
R2105
14V/50V
NF
B2101
5140251

Figure 110 Internal earpiece circuitry

Internal speaker

Internal speaker is used for Internal HandsFree (IHF) call mode.

A dynamic 16mm speaker is connected to Retu ASIC's outputs HFSpP and HFSpN.

IHF amplifier integrated in Retu is a Digital Pulse Modulated Amplifier (DPMA).

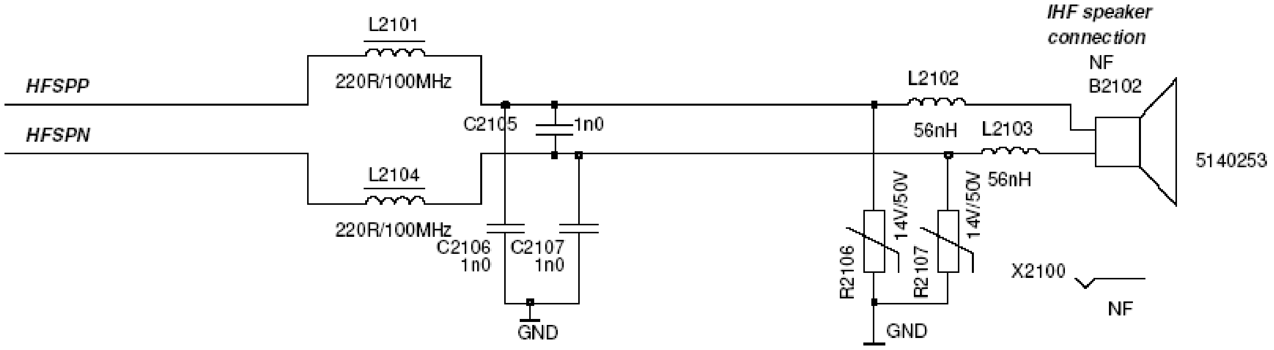

L2101
220R/100MHz
HFSPP
HFSPN
L2104
220R/100MHz
C2105
1n0
C2106
1n0
C2107
1n0
GND
L2102
56nH
L2103
56nH
R2106
14V/50V
R2107
14V/50V
GND
IHF speaker connection
NF
B2102
5140253
X2100
NF

Figure 111 Internal speaker circuitry

External earpiece

Galvanic accessories are connected to the system connector (Pop-Port^{TM}).

Accessory audio mode is automatically enabled/disabled during connection/disconnection of dedicated phone accessories.

Retu ASIC provides two output channels in either single-ended or differential format. Retu ASIC outputs XearL and XearLC form the left channel audio output and XearR and XearRC the right channel audio output. XearLC and XearRC are the ground pins if the output works in a single-ended operation.

On the Pop-Port side, HSEAR P and HSEAR N form the left channel output and HSEAR R P and HSEAR R N the right channel output. Respectively, HSEAR N and HSEAR R N are the ground pins if the output works in a single-ended operation.

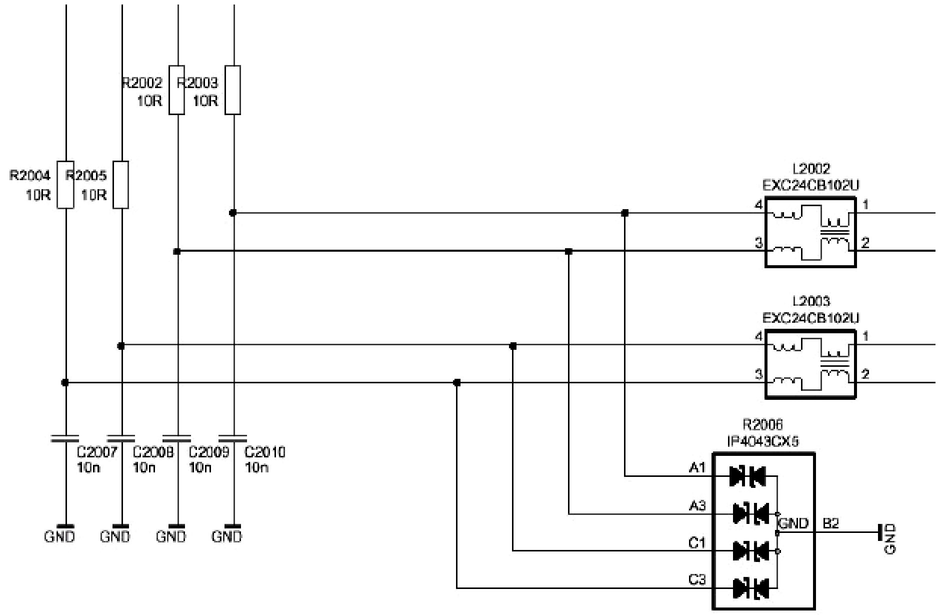

R2002
10R
R2003
10R
R2004
10R
R2005
10R
L2002
EXC24CB102U
L2003
EXC24CB102U
C2007
10n
C2008
10n
C2009
10n
C2010
10n
GND
R2006
IP4043CX5
A1
A3
C1
C3
B2

Figure 112 External earpiece circuitry (Pop-Port connected on the right)

Vibra circuitry

Vibra is used for vibra-alarm function.

The vibra motor is connected to the Retu ASIC VibraP and VibraN Pulse Width Modulated (PWM) outputs.

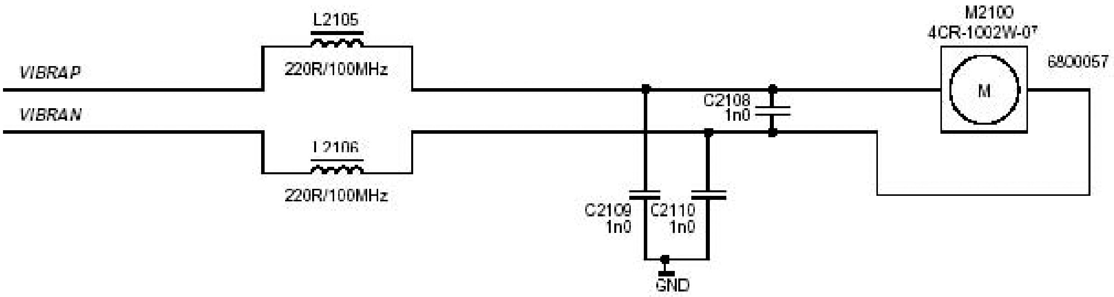

L2105
220R/100MHz
VIBRAP
VIBRAN
L2106
220R/100MHz
M2100
4CR-1002W-07
6800057
M
C2108
1n0
C2109
1n0
C2110
1n0
GND

Figure 113 Vibra circuitry

Pop-port^{TM} connector

Pop-Port^{TM} connector provides a fully differential 4–wire stereo line-level output connection and fully differential 2-wire mono line-level or microphone level input connection.

The handsfree driver in Retu is meant for the headset.

The output is driven in a fully differential mode. In the fully differential mode, the handsfree pin is the negative output and the HFCM pin is the positive output. The gain of the handsfree driver in the differential mode is 6 dB.

The earpiece and headset signals are multiplexed so that the outputs cannot be used simultaneously.

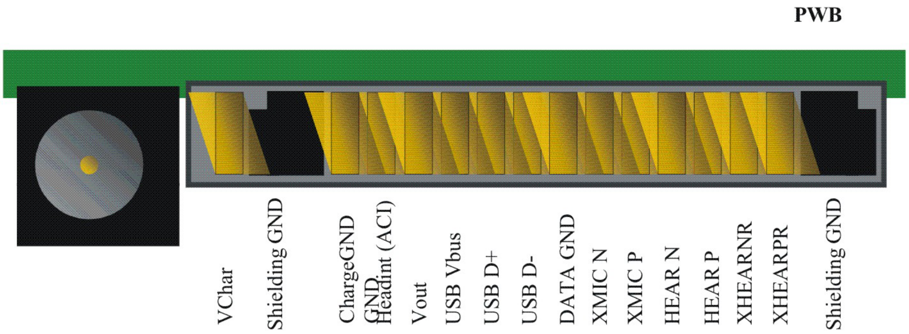

PWB
VChar
Shielding GND
ChargeGND
GND
Headint (ACI)
Vout
USB Vbus
USB D+
USB D-
DATA GND
XMIC N
XMIC P
HEAR N
HEAR P
XHEARNR
XHEARPR
Shielding GND

Figure 114 External audio connector

Table 20 Audio connector pin assignments

Pin #/ Signal name	Signal description	Spectral range	Voltage/ Current levels	Max or nominal serial impedance	Notes
1/ Charge	V Charge	DC	0-9V/ 0.85A		
2/ GND	Charge GND	-	0.85A	100mΩ (PWB+ conn.)	
3/ ACI	ACI	1kbits/s	Digital 0 / 2.5-2.78V	47Ω	Insertion & removal detection
4/ Vout	DC out	DC	2.78V 70 mA 2.5V 90mA	100mΩ (PWB+ conn.)	200mW
9 / XMIC N	Audio in	300-8k	1Vpp & 2.5-2.78VDC		
10 / XMIC P	Audio in	300-8k	1Vpp & 2.5-2.78VDC		
11 / HEAR N	Audio out	20-20k	1Vpp	10Ω	
12 / HEAR P	Audio out	20-20k	1Vpp	10Ω	
13 / HEAR R N	Audio out	20-20k	1Vpp	10Ω	Not conn. in mono
14 / HEAR R P	Audio out	20-20k	1Vpp	10Ω	Not conn. in mono

Baseband technical specifications

External interfaces

External interfaces

Name of Connection	Connector reference
USB	X2001
Charger	X2000

Name of Connection	Connector reference
Headset	X2001
SIM	X2700
RS MMC	X5200
Battery connector	X2070

ACI interface electrical characteristics

Description	Parameter	Min	Typ	Max	Unit	Notes
Accessory detection						
Headset detection threshold		1.75	1.9	2.05	V	Retu specific
Headset detection hysteresis			25		mV	
Headset detection pull ups		1	2	4	uA	
After Mbus is switched to HeadDet						
High-level input voltage (VDDS = 1.8V)	V_{IH}	0.7 x V_{DDS}		V_{DDS}	V	RAP3G specific
Low-level input voltage	V_{IL}	0		0.3 x V_{DDS}	V	
High-level output voltage	V_{OH}	0.8 x V_{DDS}		V_{DDS}	V	
Low-level output voltage	V_{OL}	0		0.22 x VDDS	V	
Rise/fall time	tR/tF			25	ns	

VOUT electrical characteristics

Description	Parameter	Min	Max	Unit	Notes
Vout regulator for external accessories	VOUT	2.43	2.57	V	Max load 90mA

USB IF electrical characteristics

Description	Parameter	Min	Max	Unit	Notes
Absolute maximum voltage on D+ and D-	$V_{D+/D-}$	-1	4.6	V	USB specification revision 2.0
Supply voltage	VBUS	4.4	5.25	V	
Supply current:					
Functioning	I_{VBUS}		100	mA	
Suspended	I_{VBUS}		500	uA	
Unconfigured	I_{VBUS}		100	mA	
High-level input voltage:				V	
High (driven)	V_{IH}	2			
High (floating)	V_{IHZ}	2.7	3.6		
Low-level input voltage	V_{IL}		0.8	V	
Differential input sensitivity	V_{DI}	0.2		V	|(D+) - (D-)|
Differential input voltage range	V_{CM}	0.8	2.5	V	Included VDI range
Low-level output voltage	V_{OL}	0	0.3	V	
High-level output voltage (driven)	V_{OH}	2.8	3.6	V	
Output signal crossover voltage	V_{CRS}	1.3	2	V	

FBUS interface electrical characteristics

Description	Parameter	Min	Max	Unit	Notes
High-level input voltage	V_{IH}	0.7 x V_{DDSHV2}	V_{DDSHV2}	V	Helen2/3 specific
Low-level Input voltage	V_{IL}	0	0.3 x V_{DDSHV2}	V	

Description	Parameter	Min	Max	Unit	Notes
High-level output voltage	V_{OH}	0.8 x V_{DDSHV2}	V_{DDSHV2}	V	
Low-level output voltage	V_{OL}	0	0.22 x V_{DDSHV2}	V	
Rise/fall time	tR/tF	0	25	ns	
(VDDSHV2 = 1.8V)					

Headset hook detection interface (XMICN) electrical characteristics

Description	Min	Typ	Max	Unit	Notes
Hook detection threshold 1	1.25	1.35	1.45	V	Two fixed thresholds inside Retu. Selectable by SW
Hook detection threshold 2	0.5	0.6	0.7	V	
Hook detection hysteresis		25		mV	
Hook detection pull ups	1	2	4	uA	

Audio signal electrical characteristics

Description	Parameter	Typ	Unit	Notes
XMIC N	Audio in	1	V_{pp}	DC Offset 2.5-2.78V
XMIC P	Audio in	1	V_{pp}	DC Offset 2.5-2.78V
HSEAR N	Audio out	1	V_{pp}	10Ω nominal serial impedance
HSEAR P	Audio out	1	V_{pp}	10Ω nominal serial impedance
HSEAR R N	Audio out	1	V_{pp}	10Ω nominal serial impedance Not connected in mono
HSEAR R P	Audio out	1	V_{pp}	10Ω nominal serial impedance Not connected in mono

SIM IF connections

Pin	Signal	I/O	Engine connection		Notes
C1	VSIM	Out	Retu	VSIM1	Supply voltage to SIM card, 1.8V or 3.0V.
C2	SIMRST	Out	Retu	SIM1Rst	Reset signal to SIM card
C3	SIMCLK	Out	Retu	SIM1ClkC	Clock signal to SIM card
C5	GND	-	GND		Ground
C7	SIMDATA	In/Out	Retu	SIM1DaC	Data input / output

RS MMC interface connections

Pin	Signal	I/O	Engine connection		Notes
1	RSV		NC	NC	Reserved for future use
2	CMD	<->	Helen2/3	MMC2_CMD	Command/ Response
3	Vss1		GND		Ground
4	V_{DD}	<-	Retu	VSIM2	VSIM2, supply voltage 1.8 (Max 70mA)
5	CLK	<-	Helen2/3	MMC2_CLK	External clock for the MMC card, Max 20 MHz
6	Vss2		GND		Ground
7	DAT	<->	Helen2/3	MMC2_DAT0	Bi-directional data bus
-	MMCDET	->	Helen2/3	btwake1(in) [P10]	MMC card detect

Charger connector and charging interface connections & electrical characteristics

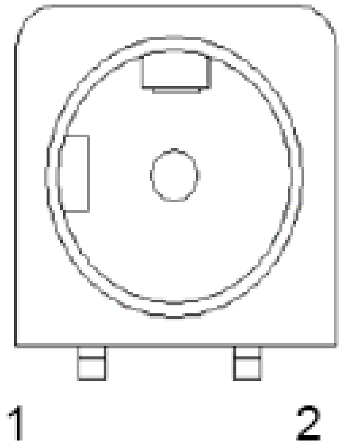


Figure 115 Charger connector

Table 21 Charging interface connections

Pin	Signal	I/O	Engine connection		Notes
1	Vchar	In	Tahvo	VCharIn1, 2	Charging voltage / charger detection, Center pin
2	Charge GND		Ground		Charger ground

Table 22 Charging IF electrical characteristics

Description	Parameter	Min	Max	Unit	Notes
Vchar	V Charge	0	9	V	Center pin
Vchar	I Charge		0.85	A	Center pin
Charge GND			0.85	A	
Threshold for charging, rising (TAHVO)	V_{MSTR+}	2.1		V	Typical value
Threshold for charging, falling (TAHVO)	V_{MSTR-}	1.9		V	Typical value

Battery connector and interface connections & electrical characteristics

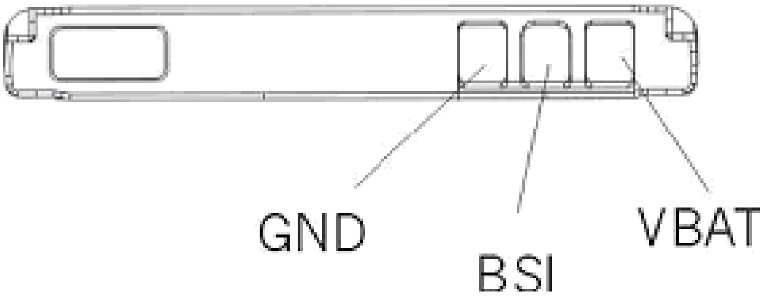


Figure 116 Battery connector

Table 23 Battery interface connections

Pin	Signal	I/O	Engine connection		Notes
1	VBAT	->	Retu	VBAT	Battery voltage
2	BSI	->	Retu	BSI	Battery size indication (fixed resistor inside the battery pack)
3	GND		GND		Ground

Table 24 Battery IF electrical characteristics

Description	Parameter	Max	Unit
Operation voltage	V_{IN}	4.23	VDC
Current rating	I_{IN}	0.9	A

Internal interfaces

Internal interfaces

Name of Connection	Connector reference	Notes
UI connector	X4400	
Display	X4401	
Camera	X1470	Mirage 1.3X
ALS	V4400	Ambient Light Sensor
Vibra	M2100	
Microphone	B2100	
Earpiece	B2101	
IHF speaker	B2102	

UI module connector and IF connections

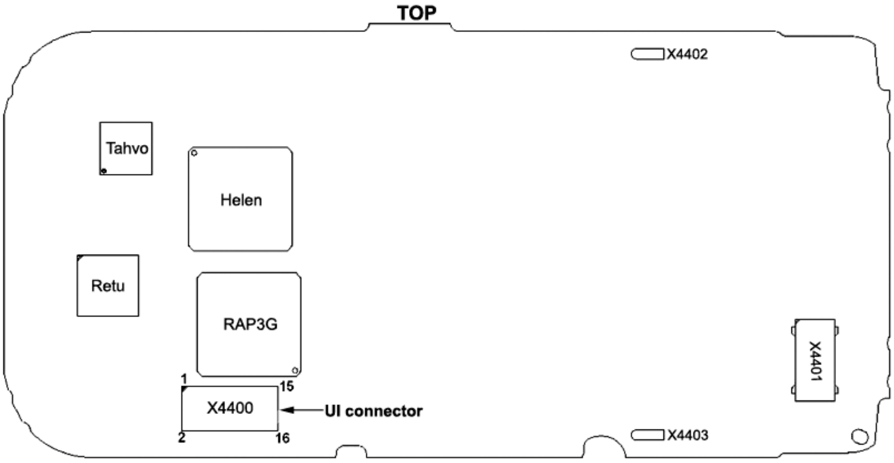

TOP
X4402
Tahvo
Helen
Retu
RAP3G
X4401
1
15
X4400
UI connector
2
16
X4403

Figure 117 UI connector

Table 25 User interface connections

Pin	Signal	I/O	Engine connection		Notes
1	GND		GND		
2	LED+	<-	N2301	VLEDOUT2	Discrete Backlight SMPS (controlled by Tahvo)
3	Col2	->	Helen3	Kbc_2	
4	LED-	->	R2305 + V2300	SETCURR2	Serial resistor + Transistor switch (controlled by Tahvo)
5	Col1	->	Helen3	Kbc_1	Voice switch connection
6	GND		GND		
7	Row3	->	Helen3	Kbr_3	
8	Row2	->	Helen3	Kbr_2	
9	Row1	->	Helen3	Kbr_1	
10	Row6	->	Helen3	Kbr_6	
11	Row0	->	Helen3	Kbr_0	
12	Col0	->	Helen3	Kbc_0	
13	Row5	->	Helen3	Kbr_5	Voice switch connection
14	Row4	->	Helen3	Kbr_4	

Pin	Signal	I/O	Engine connection		Notes
15	GND		GND		
16	Col3	->	Helen3	Kbc_3	

Keyboard interface electrical characteristics

Description	Parameter	Min	Typ	Max	Unit	Notes
High-level input voltage	V_{IH}	0.65* V_{DDS}	V_{DDS}	0.3+ V_{DDS}	V	Row
Low-level input voltage	V_{IL}	-0.3	0	0.35* V_{DDS}	V	Row
High-level output voltage	V_{OH}	1.62	V_{DDS}	1.98	V	Column
Low-level output voltage	V_{OL}		0	0.45	V	Column
(VDDS = 1.8V)						

Display connector and interface connections

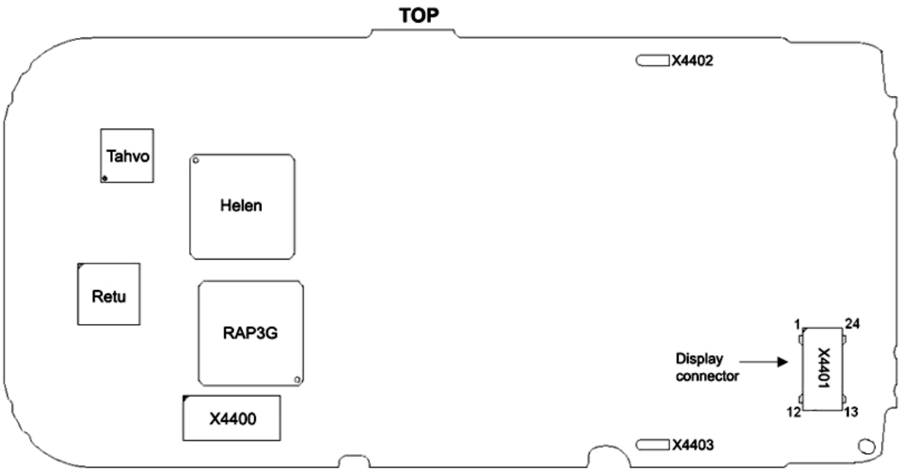


Figure 118 Display connector

Table 26 Display interface connections

Pin	Signal	I/O	Engine connection		Notes
1	GND				
2	WRX	->	Helen3	Lcdwrx	Write Enable (active low)
3	GND				
4	D0	<->	Helen3	Lcdda0	Data
5	D1	<->	Helen3	Lcdda1	Data

Pin	Signal	I/O	Engine connection		Notes
6	D2	<->	Helen3	Lcdda2	Data
7	D3	<->	Helen3	Lcdda3	Data
8	GND				
9	VDDI	<-	Retu	VIO	Interface voltage
10	VDD	<-	Retu	VAUX	Core voltage
11	GND				
12	LEDin	<-	N2301	VLEDOUT1	N2301 is controlled by Tahvo
13	LEDout	->	R2304	SETCURR1	Sink resistor
14	GND				
15	CSX	<-	Helen3	Lcdcsx	Chip Select (active low)
16	D/CX	<-	Helen3	Lcdcmd	Data/ Command select (high=data, low =command)
17	GND				
18	D7	<->	Helen3	Lcdda7	Data
19	D6	<->	Helen3	Lcdda6	Data
20	D5	<->	Helen3	Lcdda5	Data
21	D4	<->	Helen3	Lcdda4	Data
22	TE	->	Helen3	Te	Tearing Effect
23	RDX	<-	Helen3	Lcdrdx	Read Enable (active low)
24	RESX	<-	Helen3	Gpio_60	Reset (active low)

Camera interface connections and electrical characteristics

Table 27 Camera interface connections

Pin	Signal	I/O	Engine connection		Notes
1	GND1				Ground line corresponding to VDD

Pin	Signal	I/O	Engine connection		Notes
2	SDA	<->	Helen3	sda	I2C serial control bus data
3	D+	->	Helen3	Ccpdap	Differential serial data, positive node
4	SCL	<-	Helen3	scl	I2C serial control bus clock
5	D-	->	Helen3	Ccpdan	Differential serial data, negative node
6	CAMCLK	<-	Helen3	ExtClk	System clock for camera module
7	VDDI	<-	Regulator	VCAM	Camera Digital Voltage
8	GND3				Ground line corresponding to ExtClk
9	CLK+	->	Helen3	Ccpclkp	Differential serial clock, positive node
10	CAMVCTRL	<-	Helen3	VCtrl	Camera module activating signal
11	CLK-	->	Helen3	Ccpclkn	Differential serial clock, negative node
12	VDD	<-	Retu	VAUX	Camera Analog Voltage
13	Strobe	->	R2013 / R2014	Cam_strobe	Strobe timing pulse
14	GND2				Ground line corresponding to VDDI

Table 28 Camera CCP IF electrical characteristics

Description	Parameter	Min	Typ	Max	Unit	Notes
Common mode voltage	VCMF	0.8	0.9	1	V	-1
Differential voltage swing	VOD	100	150	250	mV	-2
Operating frequency	fCLK	1		175	MHz	SW controls frequency
Differential rise and fall time		300		800	ps	-3

Note:

- Common mode voltage is a mean value of high and low states of one single-ended signal.
- Differential voltage swing is differential amplitude between signals of differential pair.
- Differential transitions should be only measured with good equipment (bandwith > 1GHz), otherwise results will seem too slow.

Table 29 Camera supply voltage characteristics

Description	Parameter	Min	Typ	Max	Unit
Camera analog voltage	VDD	2.37	2.5	2.63	V
Camera digital voltage	VDDI	1.4	1.5	1.65V	V

Table 30 Camera control IF electrical characteristics

Description	Parameter	Min	Typ.	Max	Unit	Notes
SDA, SCL, Vctrl, ExtClk	VIH	1.5	1.8	VDD	V	High-level input voltage
SDA, SCL, Vctrl, ExtClk	VIL	0	-	0.54	V	Low-level input voltage
SDA	VOL	0	-	0.4	V	High-level output voltage
Regulator Enable	VOH	1.35	1.8	2.3V	V	Helen3 GPIO High-level output voltage

Description	Parameter	Min	Typ.	Max	Unit	Notes
Cam_strobe	VOH	0.8 x VDD	-	VDD		High-level output voltage
Cam_strobe	VOL	0	-	0.4	V	Low-level output voltage
ExtClk	fExtClk		9.6		MHz	SW controls frequency
SDA, SCL	tR			300	ns	Risetime

Slider switch electrical characteristics

Signal name	From	To	Low value	High value	Description
GPIO53	Helen	S5202	160mV	1,8V	Slider switch cover status signal.

Flash LED interface and electrical characteristics

Table 31 Flash LED interface connections

Signal name	From	To	Description
GPIO28	Helen	N1471	Indicator mode enable signal
ARMIO4	Helen	N1471, V1472	Flash mode enable test signal (only test use)
VBAT	Battery	N1471	Battery nominal voltage
STROBE	MirageX	N1471, V1472	Flash light enable signal from back camera

Table 32 Flash LED interface electrical characteristics

Description	Parameter	Min	Typ	Max	Unit
GPIO28	GPIO output	1.72	1.8	1.92	V
ARMIO4	GPIO output	1.72	1.8	1.92	V
STROBE	Strobe signal output	2	-	2.5	V

Back-up battery interface connections and electrical characteristics

Table 33 Back-up battery connections

Pin name	I/O	Connection	Notes
L2207, VBack	->	Retu, VBack	Back-up battery G2200 is connected to RETU via coil

Table 34 Back-up battery electrical characteristics

Description	Parameter	Min	Typ	Max	Unit
Back-Up Battery Voltage	Vback	0	2.5	2.7	V

RF description

Introduction to receiver functionality

Receiver functions are implemented in RF ASIC N7500.

The receiver is a linear direct conversion receiver consisting of separate front ends (LNA and demodulator) for each supported system.

After the demodulators, the signal paths are combined to one common BB path.

GSM receiver

As GSM Rx branches are functionally identical, the following description is applicable to all of them.

The received signal goes from the GSM antenna to the antenna switch module. The switch module contains PIN diode switches for a band and Rx/Tx selection and also Rx SAW filters.

The antenna switch module is followed by integrated LNAs residing in N7501.

The LNAs are followed by demodulators which downconvert the signal to baseband I and Q signals. The channel select filter is set to 115 kHz.

The DC compensation is carried out before the reception slot.

During an operation called DCN1, a sample of the DC level of the signal is stored in sufficiently large off chip capacitors. During reception, information is in turn used for subtracting the DC information from the input signal of the AGC amplifier.

DCN0 operation is carried out to discharge any charge from the capacitors before DCN1. This guarantees that the starting point for the DC compensation is always the same.

Introduction to transmitter functionality

Transmitter functions are implemented in the RF ASIC N7501. It contains a BB frequency low pass filter, which is tunable according to the signal bandwidth of the system in use.

In addition, N7501 contains separate RF paths comprising a final frequency IQ modulator and VGA amplifiers.

In order to eliminate the effect of process variations on the low pass filter characteristics, a tuning procedure is carried out in production. The same tunings must be performed if the RF ASIC N7501 is changed.

GSM transmitter

An analogue IQ modulated signal is received to N7501 from digital BB.

The signal is first low pass filtered with filter corner frequency set to approximately 200 kHz. After the filter, the signal is routed to the GSM modulator.

The appropriate routing after the modulator is selected by biasing either EGSM900 (/GSM850) or GSM1800/1900 variable gain amplifier. The amplifier gives 40 dB of power control dynamic range.

After the VGA stage the signal exits N7501. In case of GSM1800/1900 the signal goes directly to the GSM PA module. In case of EGSM900 (and GSM850), the PA module is preceded by a SAW filter. After the filter, the signal is fed to GSM PA module. Finally the signal is routed via antenna switch to the antenna.

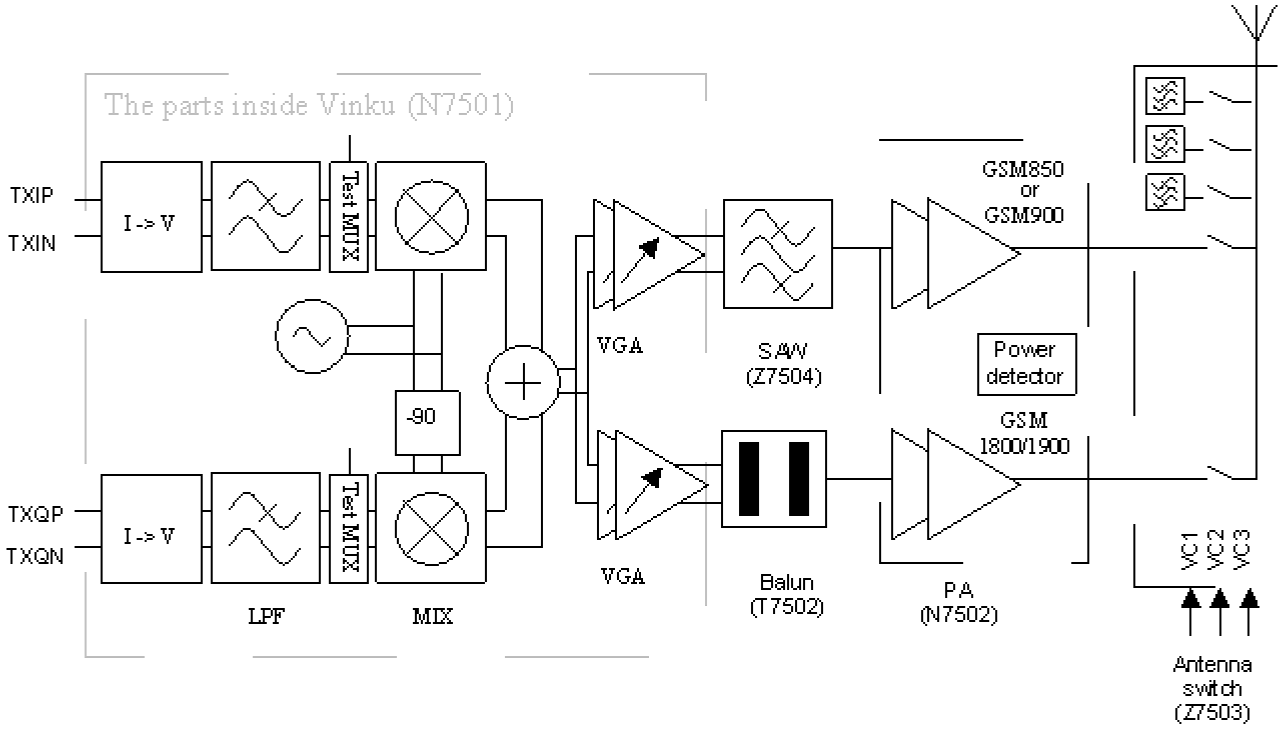


Figure 119 GSM transmitter

GSM power control

A closed control loop comprise an integrated power detector (in PA module) and an error amplifier. The error amplifier resides in N7501, and it controls the transmitter power of GSM.

Detector output from the PA gives a DC level proportional to the output power. The DC voltage is fed to the negative input of the error amplifier, where it is compared to the level of the reference signal, TXC. TXC is got from the BB circuitry. The output of the error amplifier is fed to a buffer amplifier, which in turn steers the VGA amplifier.

The TXC signal also contains the output power ramp waveform, which is optimized in order to meet the transient spectrum and burst timing requirements. PA is switched on and off by changing the bias currents. As a result the output power ramping and final power level of the transmitter are set in a controlled manner.

During EDGE operation 8-PSK modulation is utilized. In the 8-PSK modulation, there are envelope variations during the data transmission. This presents extra requirement to the linearity of the PA. Therefore the PA is set to a dedicated EDGE mode by setting a specific mode control signal up (Vmode). The bias currents are also adjusted in order to improve the linearity.

Because of the 8-PSK modulation, the power control loop has to be opened during the data transmission in EDGE mode. Otherwise a part of the envelope variations could be canceled out by control loop and signal information contents and spectrum would be deteriorated. Loop is opened with a dedicated TXA-signal via RFBus. When the power is ramped up, a modulating bit sequence producing a constant envelope waveform is used and the power control loop is closed. Once the wanted power level has been reached, the loop is opened and the power control voltage is kept constant by a capacitor integrated to N7501 Tx ASIC. When the active part of the burst is over, the loop is again closed and the power is ramped down. The TXA signal is disabled during GMSK transmission.

Power control loop is enabled and disabled by writing an appropriate register in N7501 RF ASIC. In case of dual slot transmission, the output power is ramped down between the consecutive slots.

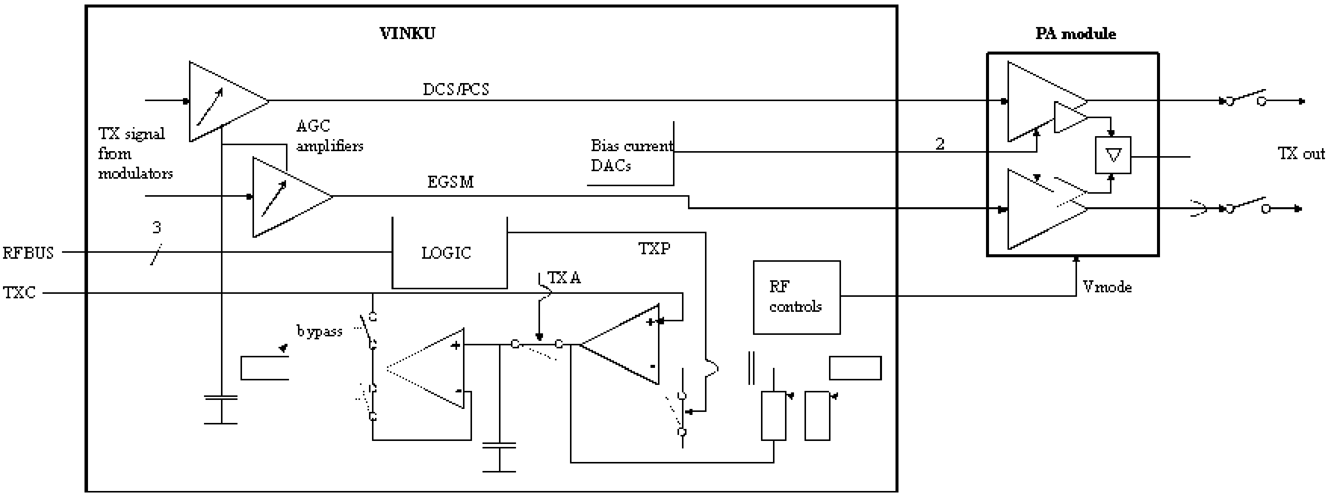

VINKU
PA module
DCS/PCS
TX signal from modulators
AGC amplifiers
Bias current DACs
2
EGSM
3
RFBUS
TXC
LOGIC
TXP
TXA
bypass
RF controls
Vmode
TX out

Figure 120 GSM/EDGE power control topology and control signals

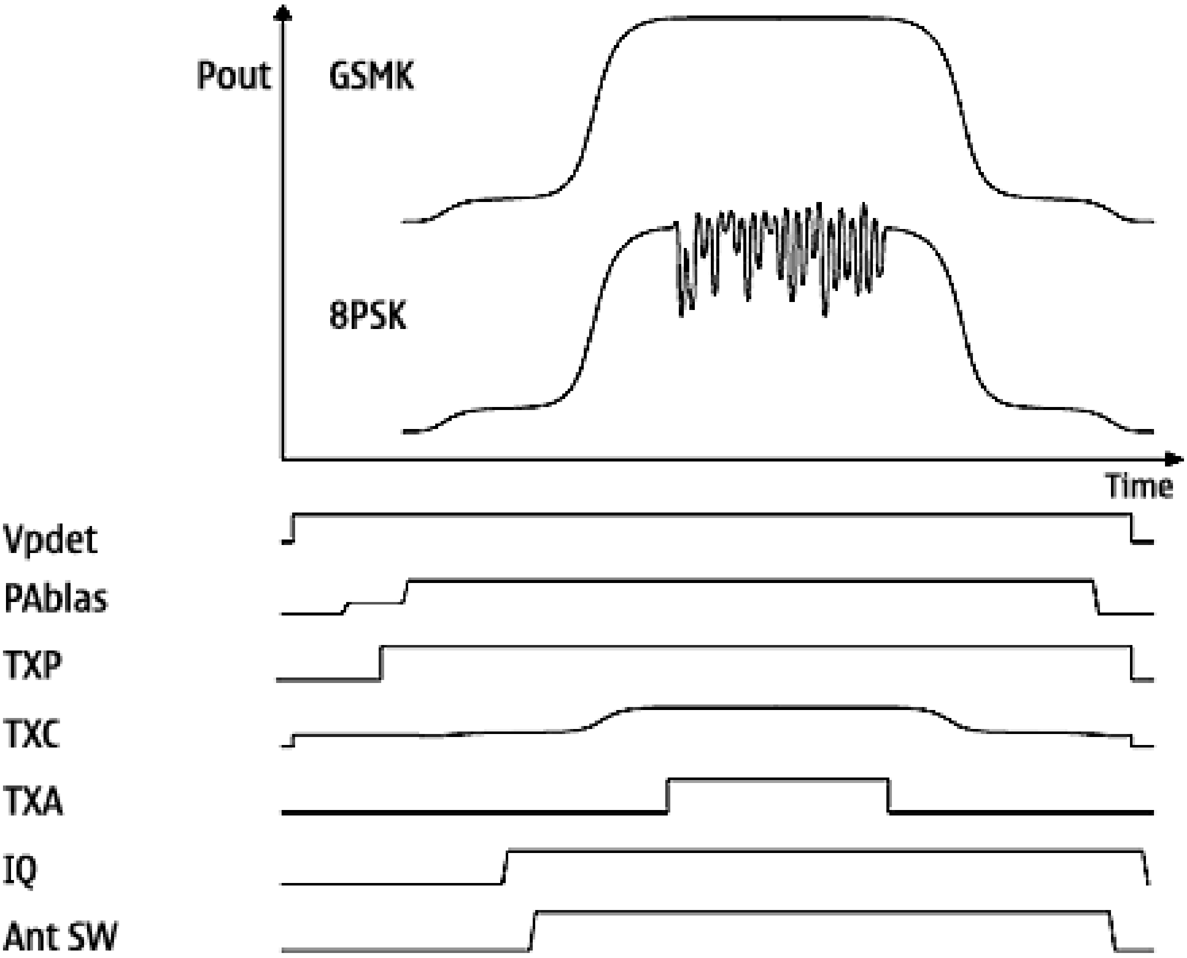


Figure 121 Power control signal usage in GSM (GMSK) and EDGE (8PSK) transmission

Note: Timings are not shown accurately in the previous figure.

GSM PA module

A single GSM/EDGE PA module contains two separate amplifier chains, one for EGSM900 (and GSM850) and another for GSM1800/1900. Both amplifiers have a battery supply connection and two bias current inputs. The bias current for final amplifier stage is adjusted according the power level in use in order to optimise efficiency. The bias currents are also used as on/off switching signals for PAs.

In the EDGE mode, PA linearity has to be higher than in GMSK mode because of envelope variations of the 8-PSK modulations. This is achieved by increasing the bias currents compared to the GMSK mode and setting a dedicated Vmode control signal up. Increasing bias currents improves the linearity of the amplifiers, but it also tends to unnecessarily increase the gain of the PA. Vmode control aims to keep the gain of the amplifiers down.

The bias current needed for the maximum and the lowest output powers is specified by a PA manufacturer. The current for the intermediate power levels is then linearly adjusted between these two values.

Frequency synthesizers

RF has separate synthesizers for Rx and Tx. Both synthesizers consist of:

- PLL
- loop filter
- VCO
- balun

The VCO frequencies are locked by PLLs into a reference oscillator, VCTCXO.

The PLLs are located in N7500 and N7501 respectively and controlled via RFBus. PLL charge pump charges or discharges the integrator capacitor in the loop filter depending on the phase of the measured frequency compared to the phase of the reference frequency. The integrator output voltage is connected to the control input of the VCO.

The VCOs operate at the channel frequency multiplied by two in the upper bands (for example, GSM1800/1900/WCDMA) and by four in EGSM900 (and GSM850, if applicable). The required frequency dividers required for modulators are integrated in N7501 and those for demodulators in N7500. The dividers are controlled via RFBus.

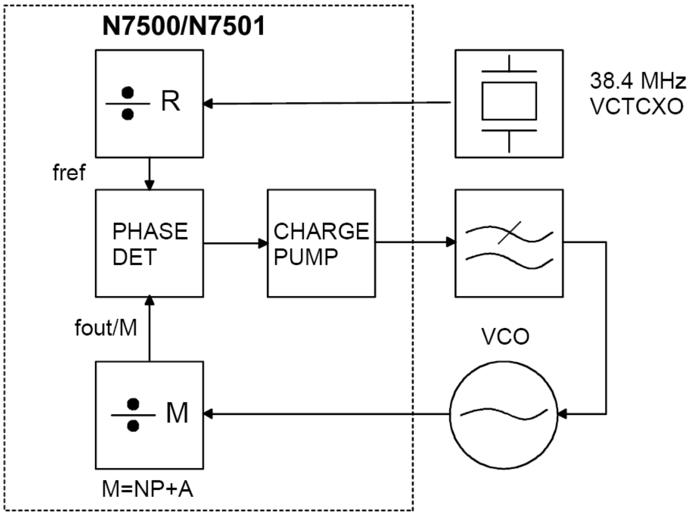


Figure 122 Phase locked loop in N7500 and N7501 (PLL)

Reference oscillators

As a reference oscillator for the frequency synthesizers a 38.4MHz VCTCXO (voltage controlled temperature compensated crystal oscillator) is used.

The output signal of the VCTCXO is directly connected to both N7500 and N7501 where it's used as synthesizer reference. N7500 also contains a balanced buffered output for supplying the clock signal to the digital BB ASIC and a single ended buffer for Bluetooth.

The frequency of the reference oscillator is locked into the frequency of the base station with the help of an AFC voltage, which is generated in BB by DSP and converted by dedicated DAC.

Regulators

N7500 and N7501 contain integrated regulators to supply regulated voltages for their internal circuitry and other RF parts. Rx VCO supply is got via a switch from N7500 VR1 regulator. VCO can be switched on and off by controlling the switch via RFBus.

Supply voltage for the VCTCXO is provided by a BB mixed mode ASIC. The same supply is used for reference clock input buffers (in N7500 and N7501), output buffers (from N7500 to BB) and for the digital control blocks of both RF ASICs. When the VCTCXO regulator is set active, the control blocks of the RF ASICs also wake up. After that the integrated regulators can be controlled via RFBus.

Other supplies, like 4.7V supply for PLL charge pumps and bias reference (VREFRF01) are also provided by the BB mixed mode ASIC.

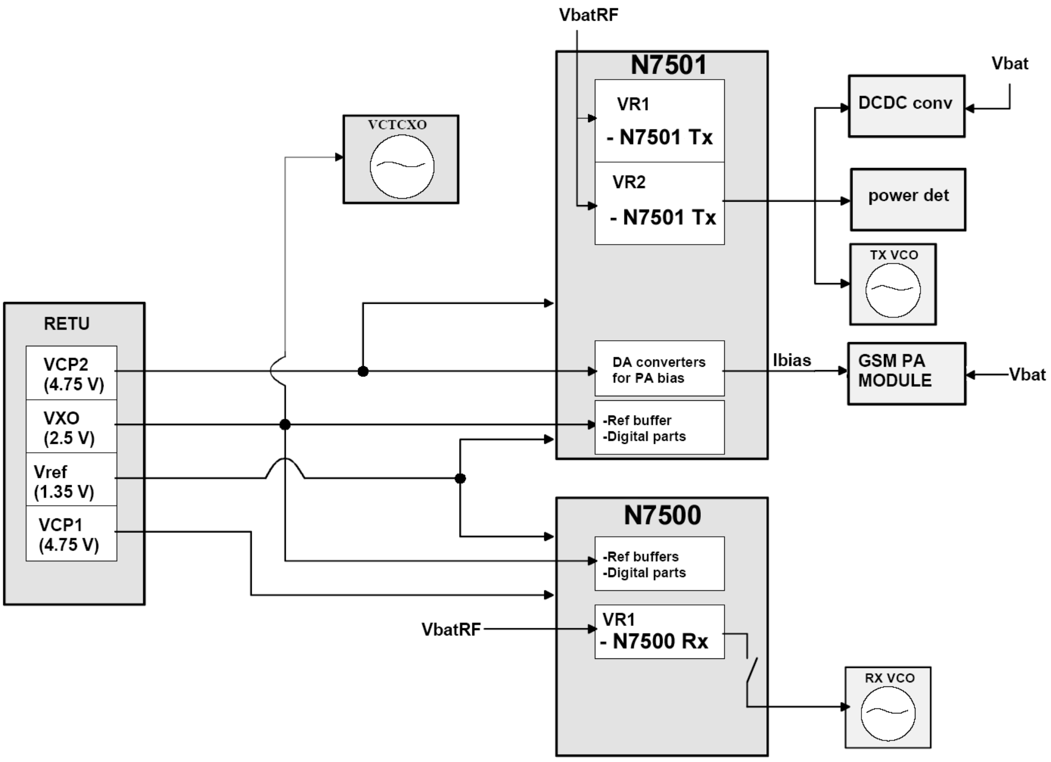

VbatRF
N7501
VR1
- N7501 Tx
VR2
- N7501 Tx
Vbat
DCDC conv
power det
TX VCO
VCTCXO
RETU
VCP2
(4.75 V)
VXO
(2.5 V)
Vref
(1.35 V)
VCP1
(4.75 V)
DA converters
for PA bias
Ibias
GSM PA
MODULE
Vbat
-Ref buffer
-Digital parts
N7500
-Ref buffers
-Digital parts
VbatRF
VR1
- N7500 Rx
RX VCO

Figure 123 RF supply connections from the BB mixed mode ASIC

Frequency mappings

GSM850 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
128	824.2	869.2	3296.8	3476.8	170	832.6	877.6	3330.4	3510.4	212	841.0	886.0	3364.0	3544.0
129	824.4	869.4	3297.6	3477.6	171	832.8	877.8	3331.2	3511.2	213	841.2	886.2	3364.8	3544.8
130	824.6	869.6	3298.4	3478.4	172	833.0	878.0	3332.0	3512.0	214	841.4	886.4	3365.6	3545.6
131	824.8	869.8	3299.2	3479.2	173	833.2	878.2	3332.8	3512.8	215	841.6	886.6	3366.4	3546.4
132	825.0	870.0	3300.0	3480.0	174	833.4	878.4	3333.6	3513.6	216	841.8	886.8	3367.2	3547.2
133	825.2	870.2	3300.8	3480.8	175	833.6	878.6	3334.4	3514.4	217	842.0	887.0	3368.0	3548.0
134	825.4	870.4	3301.6	3481.6	176	833.8	878.8	3335.2	3515.2	218	842.2	887.2	3368.8	3548.8
135	825.6	870.6	3302.4	3482.4	177	834.0	879.0	3336.0	3516.0	219	842.4	887.4	3369.6	3549.6
136	825.8	870.8	3303.2	3483.2	178	834.2	879.2	3336.8	3516.8	220	842.6	887.6	3370.4	3550.4
137	826.0	871.0	3304.0	3484.0	179	834.4	879.4	3337.6	3517.6	221	842.8	887.8	3371.2	3551.2
138	826.2	871.2	3304.8	3484.8	180	834.6	879.6	3338.4	3518.4	222	843.0	888.0	3372.0	3552.0
139	826.4	871.4	3305.6	3485.6	181	834.8	879.8	3339.2	3519.2	223	843.2	888.2	3372.8	3552.8
140	826.6	871.6	3306.4	3486.4	182	835.0	880.0	3340.0	3520.0	224	843.4	888.4	3373.6	3553.6
141	826.8	871.8	3307.2	3487.2	183	835.2	880.2	3340.8	3520.8	225	843.6	888.6	3374.4	3554.4
142	827.0	872.0	3308.0	3488.0	184	835.4	880.4	3341.6	3521.6	226	843.8	888.8	3375.2	3555.2
143	827.2	872.2	3308.8	3488.8	185	835.6	880.6	3342.4	3522.4	227	844.0	889.0	3376.0	3556.0
144	827.4	872.4	3309.6	3489.6	186	835.8	880.8	3343.2	3523.2	228	844.2	889.2	3376.8	3556.8
145	827.6	872.6	3310.4	3490.4	187	836.0	881.0	3344.0	3524.0	229	844.4	889.4	3377.6	3557.6
146	827.8	872.8	3311.2	3491.2	188	836.2	881.2	3344.8	3524.8	230	844.6	889.6	3378.4	3558.4
147	828.0	873.0	3312.0	3492.0	189	836.4	881.4	3345.6	3525.6	231	844.8	889.8	3379.2	3559.2
148	828.2	873.2	3312.8	3492.8	190	836.6	881.6	3346.4	3526.4	232	845.0	890.0	3380.0	3560.0
149	828.4	873.4	3313.6	3493.6	191	836.8	881.8	3347.2	3527.2	233	845.2	890.2	3380.8	3560.8
150	828.6	873.6	3314.4	3494.4	192	837.0	882.0	3348.0	3528.0	234	845.4	890.4	3381.6	3561.6
151	828.8	873.8	3315.2	3495.2	193	837.2	882.2	3348.8	3528.8	235	845.6	890.6	3382.4	3562.4
152	829.0	874.0	3316.0	3496.0	194	837.4	882.4	3349.6	3529.6	236	845.8	890.8	3383.2	3563.2
153	829.2	874.2	3316.8	3496.8	195	837.6	882.6	3350.4	3530.4	237	846.0	891.0	3384.0	3564.0
154	829.4	874.4	3317.6	3497.6	196	837.8	882.8	3351.2	3531.2	238	846.2	891.2	3384.8	3564.8
155	829.6	874.6	3318.4	3498.4	197	838.0	883.0	3352.0	3532.0	239	846.4	891.4	3385.6	3565.6
156	829.8	874.8	3319.2	3499.2	198	838.2	883.2	3352.8	3532.8	240	846.6	891.6	3386.4	3566.4
157	830.0	875.0	3320.0	3500.0	199	838.4	883.4	3353.6	3533.6	241	846.8	891.8	3387.2	3567.2
158	830.2	875.2	3320.8	3500.8	200	838.6	883.6	3354.4	3534.4	242	847.0	892.0	3388.0	3568.0
159	830.4	875.4	3321.6	3501.6	201	838.8	883.8	3355.2	3535.2	243	847.2	892.2	3388.8	3568.8
160	830.6	875.6	3322.4	3502.4	202	839.0	884.0	3356.0	3536.0	244	847.4	892.4	3389.6	3569.6
161	830.8	875.8	3323.2	3503.2	203	839.2	884.2	3356.8	3536.8	245	847.6	892.6	3390.4	3570.4
162	831.0	876.0	3324.0	3504.0	204	839.4	884.4	3357.6	3537.6	246	847.8	892.8	3391.2	3571.2
163	831.2	876.2	3324.8	3504.8	205	839.6	884.6	3358.4	3538.4	247	848.0	893.0	3392.0	3572.0
164	831.4	876.4	3325.6	3505.6	206	839.8	884.8	3359.2	3539.2	248	848.2	893.2	3392.8	3572.8
165	831.6	876.6	3326.4	3506.4	207	840.0	885.0	3360.0	3540.0	249	848.4	893.4	3393.6	3573.6
166	831.8	876.8	3327.2	3507.2	208	840.2	885.2	3360.8	3540.8	250	848.6	893.6	3394.4	3574.4
167	832.0	877.0	3328.0	3508.0	209	840.4	885.4	3361.6	3541.6	251	848.8	893.8	3395.2	3575.2

EGSM900 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
975	880,2	925,2	3520,8	3700,8	1	890,2	935,2	3560,8	3740,8	63	902,6	947,6	3610,4	3790,4
976	880,4	925,4	3521,6	3701,6	2	890,4	935,4	3561,6	3741,6	64	902,8	947,8	3611,2	3791,2
977	880,6	925,6	3522,4	3702,4	3	890,6	935,6	3562,4	3742,4	65	903,0	948,0	3612,0	3792,0
978	880,8	925,8	3523,2	3703,2	4	890,8	935,8	3563,2	3743,2	66	903,2	948,2	3612,8	3792,8
979	881,0	926,0	3524,0	3704,0	5	891,0	936,0	3564,0	3744,0	67	903,4	948,4	3613,6	3793,6
980	881,2	926,2	3524,8	3704,8	6	891,2	936,2	3564,8	3744,8	68	903,6	948,6	3614,4	3794,4
981	881,4	926,4	3525,6	3705,6	7	891,4	936,4	3565,6	3745,6	69	903,8	948,8	3615,2	3795,2
982	881,6	926,6	3526,4	3706,4	8	891,6	936,6	3566,4	3746,4	70	904,0	949,0	3616,0	3796,0
983	881,8	926,8	3527,2	3707,2	9	891,8	936,8	3567,2	3747,2	71	904,2	949,2	3616,8	3796,8
984	882,0	927,0	3528,0	3708,0	10	892,0	937,0	3568,0	3748,0	72	904,4	949,4	3617,6	3797,6
985	882,2	927,2	3528,8	3708,8	11	892,2	937,2	3568,8	3748,8	73	904,6	949,6	3618,4	3798,4
986	882,4	927,4	3529,6	3709,6	12	892,4	937,4	3569,6	3749,6	74	904,8	949,8	3619,2	3799,2
987	882,6	927,6	3530,4	3710,4	13	892,6	937,6	3570,4	3750,4	75	905,0	950,0	3620,0	3800,0
988	882,8	927,8	3531,2	3711,2	14	892,8	937,8	3571,2	3751,2	76	905,2	950,2	3620,8	3800,8
989	883,0	928,0	3532,0	3712,0	15	893,0	938,0	3572,0	3752,0	77	905,4	950,4	3621,6	3801,6
990	883,2	928,2	3532,8	3712,8	16	893,2	938,2	3572,8	3752,8	78	905,6	950,6	3622,4	3802,4
991	883,4	928,4	3533,6	3713,6	17	893,4	938,4	3573,6	3753,6	79	905,8	950,8	3623,2	3803,2
992	883,6	928,6	3534,4	3714,4	18	893,6	938,6	3574,4	3754,4	80	906,0	951,0	3624,0	3804,0
993	883,8	928,8	3535,2	3715,2	19	893,8	938,8	3575,2	3755,2	81	906,2	951,2	3624,8	3804,8
994	884,0	929,0	3536,0	3716,0	20	894,0	939,0	3576,0	3756,0	82	906,4	951,4	3625,6	3805,6
995	884,2	929,2	3536,8	3716,8	21	894,2	939,2	3576,8	3756,8	83	906,6	951,6	3626,4	3806,4
996	884,4	929,4	3537,6	3717,6	22	894,4	939,4	3577,6	3757,6	84	906,8	951,8	3627,2	3807,2
997	884,6	929,6	3538,4	3718,4	23	894,6	939,6	3578,4	3758,4	85	907,0	952,0	3628,0	3808,0
998	884,8	929,8	3539,2	3719,2	24	894,8	939,8	3579,2	3759,2	86	907,2	952,2	3628,8	3808,8
999	885,0	930,0	3540,0	3720,0	25	895,0	940,0	3580,0	3760,0	87	907,4	952,4	3629,6	3809,6
1000	885,2	930,2	3540,8	3720,8	26	895,2	940,2	3580,8	3760,8	88	907,6	952,6	3630,4	3810,4
1001	885,4	930,4	3541,6	3721,6	27	895,4	940,4	3581,6	3761,6	89	907,8	952,8	3631,2	3811,2
1002	885,6	930,6	3542,4	3722,4	28	895,6	940,6	3582,4	3762,4	90	908,0	953,0	3632,0	3812,0
1003	885,8	930,8	3543,2	3723,2	29	895,8	940,8	3583,2	3763,2	91	908,2	953,2	3632,8	3812,8
1004	886,0	931,0	3544,0	3724,0	30	896,0	941,0	3584,0	3764,0	92	908,4	953,4	3633,6	3813,6
1005	886,2	931,2	3544,8	3724,8	31	896,2	941,2	3584,8	3764,8	93	908,6	953,6	3634,4	3814,4
1006	886,4	931,4	3545,6	3725,6	32	896,4	941,4	3585,6	3765,6	94	908,8	953,8	3635,2	3815,2
1007	886,6	931,6	3546,4	3726,4	33	896,6	941,6	3586,4	3766,4	95	909,0	954,0	3636,0	3816,0
1008	886,8	931,8	3547,2	3727,2	34	896,8	941,8	3587,2	3767,2	96	909,2	954,2	3636,8	3816,8
1009	887,0	932,0	3548,0	3728,0	35	897,0	942,0	3588,0	3768,0	97	909,4	954,4	3637,6	3817,6
1010	887,2	932,2	3548,8	3728,8	36	897,2	942,2	3588,8	3768,8	98	909,6	954,6	3638,4	3818,4
1011	887,4	932,4	3549,6	3729,6	37	897,4	942,4	3589,6	3769,6	99	909,8	954,8	3639,2	3819,2
1012	887,6	932,6	3550,4	3730,4	38	897,6	942,6	3590,4	3770,4	100	910,0	955,0	3640,0	3820,0
1013	887,8	932,8	3551,2	3731,2	39	897,8	942,8	3591,2	3771,2	101	910,2	955,2	3640,8	3820,8
1014	888,0	933,0	3552,0	3732,0	40	898,0	943,0	3592,0	3772,0	102	910,4	955,4	3641,6	3821,6
1015	888,2	933,2	3552,8	3732,8	41	898,2	943,2	3592,8	3772,8	103	910,6	955,6	3642,4	3822,4
1016	888,4	933,4	3553,6	3733,6	42	898,4	943,4	3593,6	3773,6	104	910,8	955,8	3643,2	3823,2
1017	888,6	933,6	3554,4	3734,4	43	898,6	943,6	3594,4	3774,4	105	911,0	956,0	3644,0	3824,0
1018	888,8	933,8	3555,2	3735,2	44	898,8	943,8	3595,2	3775,2	106	911,2	956,2	3644,8	3824,8
1019	889,0	934,0	3556,0	3736,0	45	899,0	944,0	3596,0	3776,0	107	911,4	956,4	3645,6	3825,6
1020	889,2	934,2	3556,8	3736,8	46	899,2	944,2	3596,8	3776,8	108	911,6	956,6	3646,4	3826,4
1021	889,4	934,4	3557,6	3737,6	47	899,4	944,4	3597,6	3777,6	109	911,8	956,8	3647,2	3827,2
1022	889,6	934,6	3558,4	3738,4	48	899,6	944,6	3598,4	3778,4	110	912,0	957,0	3648,0	3828,0
1023	889,8	934,8	3559,2	3739,2	49	899,8	944,8	3599,2	3779,2	111	912,2	957,2	3648,8	3828,8
0	890,0	935,0	3560,0	3740,0	50	900,0	945,0	3600,0	3780,0	112	912,4	957,4	3649,6	3829,6
					51	900,2	945,2	3600,8	3780,8	113	912,6	957,6	3650,4	3830,4
					52	900,4	945,4	3601,6	3781,6	114	912,8	957,8	3651,2	3831,2
					53	900,6	945,6	3602,4	3782,4	115	913,0	958,0	3652,0	3832,0
					54	900,8	945,8	3603,2	3783,2	116	913,2	958,2	3652,8	3832,8
					55	901,0	946,0	3604,0	3784,0	117	913,4	958,4	3653,6	3833,6
					56	901,2	946,2	3604,8	3784,8	118	913,6	958,6	3654,4	3834,4
					57	901,4	946,4	3605,6	3785,6	119	913,8	958,8	3655,2	3835,2
					58	901,6	946,6	3606,4	3786,4	120	914,0	959,0	3656,0	3836,0
					59	901,8	946,8	3607,2	3787,2	121	914,2	959,2	3656,8	3836,8
					60	902,0	947,0	3608,0	3788,0	122	914,4	959,4	3657,6	3837,6
					61	902,2	947,2	3608,8	3788,8	123	914,6	959,6	3658,4	3838,4
					62	902,4	947,4	3609,6	3789,6	124	914,8	959,8	3659,2	3839,2

GSM1800 frequencies

Ch	TX	RX	VCO TX	VCO RX
547	1717.2	1812.2	3434.4	3624.4
548	1717.4	1812.4	3434.8	3624.8
549	1717.6	1812.6	3435.2	3625.2
550	1717.8	1812.8	3435.6	3625.6
551	1718.0	1813.0	3436.0	3626.0
552	1718.2	1813.2	3436.4	3626.4
553	1718.4	1813.4	3436.8	3626.8
554	1718.6	1813.6	3437.2	3627.2
555	1718.8	1813.8	3437.6	3627.6
556	1719.0	1814.0	3438.0	3628.0
557	1719.2	1814.2	3438.4	3628.4
558	1719.4	1814.4	3438.8	3628.8
559	1719.6	1814.6	3439.2	3629.2
560	1719.8	1814.8	3439.6	3629.6
561	1720.0	1815.0	3440.0	3630.0
562	1720.2	1815.2	3440.4	3630.4
563	1720.4	1815.4	3440.8	3630.8
564	1720.6	1815.6	3441.2	3631.2
565	1720.8	1815.8	3441.6	3631.6
566	1721.0	1816.0	3442.0	3632.0
567	1721.2	1816.2	3442.4	3632.4
568	1721.4	1816.4	3442.8	3632.8
569	1721.6	1816.6	3443.2	3633.2
570	1721.8	1816.8	3443.6	3633.6
571	1722.0	1817.0	3444.0	3634.0
572	1722.2	1817.2	3444.4	3634.4
573	1722.4	1817.4	3444.8	3634.8
574	1722.6	1817.6	3445.2	3635.2
575	1722.8	1817.8	3445.6	3635.6
576	1723.0	1818.0	3446.0	3636.0
577	1723.2	1818.2	3446.4	3636.4
578	1723.4	1818.4	3446.8	3636.8
579	1723.6	1818.6	3447.2	3637.2
580	1723.8	1818.8	3447.6	3637.6
581	1724.0	1819.0	3448.0	3638.0
582	1724.2	1819.2	3448.4	3638.4
583	1724.4	1819.4	3448.8	3638.8
584	1724.6	1819.6	3449.2	3639.2
585	1724.8	1819.8	3449.6	3639.6
586	1725.0	1820.0	3450.0	3640.0
587	1725.2	1820.2	3450.4	3640.4
588	1725.4	1820.4	3450.8	3640.8
589	1725.6	1820.6	3451.2	3641.2
590	1725.8	1820.8	3451.6	3641.6
591	1726.0	1821.0	3452.0	3642.0
592	1726.2	1821.2	3452.4	3642.4
593	1726.4	1821.4	3452.8	3642.8
594	1726.6	1821.6	3453.2	3643.2
595	1726.8	1821.8	3453.6	3643.6
596	1727.0	1822.0	3454.0	3644.0
597	1727.2	1822.2	3454.4	3644.4
598	1727.4	1822.4	3454.8	3644.8
599	1727.6	1822.6	3455.2	3645.2
600	1727.8	1822.8	3455.6	3645.6
601	1728.0	1823.0	3456.0	3646.0
602	1728.2	1823.2	3456.4	3646.4
603	1728.4	1823.4	3456.8	3646.8
604	1728.6	1823.6	3457.2	3647.2
605	1728.8	1823.8	3457.6	3647.6
606	1729.0	1824.0	3458.0	3648.0
607	1729.2	1824.2	3458.4	3648.4
608	1729.4	1824.4	3458.8	3648.8
609	1729.6	1824.6	3459.2	3649.2
610	1729.8	1824.8	3459.6	3649.6
611	1730.0	1825.0	3460.0	3650.0
612	1730.2	1825.2	3460.4	3650.4
613	1730.4	1825.4	3460.8	3650.8
614	1730.6	1825.6	3461.2	3651.2
615	1730.8	1825.8	3461.6	3651.6
616	1731.0	1826.0	3462.0	3652.0
617	1731.2	1826.2	3462.4	3652.4
618	1731.4	1826.4	3462.8	3652.8
619	1731.6	1826.6	3463.2	3653.2
620	1731.8	1826.8	3463.6	3653.6
621	1732.0	1827.0	3464.0	3654.0
622	1732.2	1827.2	3464.4	3654.4
623	1732.4	1827.4	3464.8	3654.8
624	1732.6	1827.6	3465.2	3655.2
625	1732.8	1827.8	3465.6	3655.6
626	1733.0	1828.0	3466.0	3656.0
627	1733.2	1828.2	3466.4	3656.4
628	1733.4	1828.4	3466.8	3656.8
629	1733.6	1828.6	3467.2	3657.2
630	1733.8	1828.8	3467.6	3657.6
631	1734.0	1829.0	3468.0	3658.0
632	1734.2	1829.2	3468.4	3658.4
633	1734.4	1829.4	3468.8	3658.8
634	1734.6	1829.6	3469.2	3659.2
635	1734.8	1829.8	3469.6	3659.6
636	1735.0	1830.0	3470.0	3660.0
637	1735.2	1830.2	3470.4	3660.4
638	1735.4	1830.4	3470.8	3660.8
639	1735.6	1830.6	3471.2	3661.2
640	1735.8	1830.8	3471.6	3661.6
641	1736.0	1831.0	3472.0	3662.0
642	1736.2	1831.2	3472.4	3662.4
643	1736.4	1831.4	3472.8	3662.8
644	1736.6	1831.6	3473.2	3663.2
645	1736.8	1831.8	3473.6	3663.6
646	1737.0	1832.0	3474.0	3664.0
647	1737.2	1832.2	3474.4	3664.4
648	1737.4	1832.4	3474.8	3664.8
649	1737.6	1832.6	3475.2	3665.2
650	1737.8	1832.8	3475.6	3665.6
651	1738.0	1833.0	3476.0	3666.0
652	1738.2	1833.2	3476.4	3666.4
653	1738.4	1833.4	3476.8	3666.8
654	1738.6	1833.6	3477.2	3667.2
655	1738.8	1833.8	3477.6	3667.6
656	1739.0	1834.0	3478.0	3668.0
657	1739.2	1834.2	3478.4	3668.4
658	1739.4	1834.4	3478.8	3668.8
659	1739.6	1834.6	3479.2	3669.2
660	1739.8	1834.8	3479.6	3669.6
661	1740.0	1835.0	3480.0	3670.0
662	1740.2	1835.2	3480.4	3670.4
663	1740.4	1835.4	3480.8	3670.8
664	1740.6	1835.6	3481.2	3671.2
665	1740.8	1835.8	3481.6	3671.6
666	1741.0	1836.0	3482.0	3672.0
667	1741.2	1836.2	3482.4	3672.4
668	1741.4	1836.4	3482.8	3672.8
669	1741.6	1836.6	3483.2	3673.2
670	1741.8	1836.8	3483.6	3673.6
671	1742.0	1837.0	3484.0	3674.0
672	1742.2	1837.2	3484.4	3674.4
673	1742.4	1837.4	3484.8	3674.8
674	1742.6	1837.6	3485.2	3675.2
675	1742.8	1837.8	3485.6	3675.6
676	1743.0	1838.0	3486.0	3676.0
677	1743.2	1838.2	3486.4	3676.4
678	1743.4	1838.4	3486.8	3676.8
679	1743.6	1838.6	3487.2	3677.2
680	1743.8	1838.8	3487.6	3677.6
681	1744.0	1839.0	3488.0	3678.0
682	1744.2	1839.2	3488.4	3678.4
683	1744.4	1839.4	3488.8	3678.8
684	1744.6	1839.6	3489.2	3679.2
685	1744.8	1839.8	3489.6	3679.6
686	1745.0	1840.0	3490.0	3680.0
687	1745.2	1840.2	3490.4	3680.4
688	1745.4	1840.4	3490.8	3680.8
689	1745.6	1840.6	3491.2	3681.2
690	1745.8	1840.8	3491.6	3681.6
691	1746.0	1841.0	3492.0	3682.0
692	1746.2	1841.2	3492.4	3682.4
693	1746.4	1841.4	3492.8	3682.8
694	1746.6	1841.6	3493.2	3683.2
695	1746.8	1841.8	3493.6	3683.6
696	1747.0	1842.0	3494.0	3684.0
697	1747.2	1842.2	3494.4	3684.4
698	1747.4	1842.4	3494.8	3684.8
699	1747.6	1842.6	3495.2	3685.2
700	1747.8	1842.8	3495.6	3685.6
701	1748.0	1843.0	3496.0	3686.0
702	1748.2	1843.2	3496.4	3686.4
703	1748.4	1843.4	3496.8	3686.8
704	1748.6	1843.6	3497.2	3687.2
705	1748.8	1843.8	3497.6	3687.6
706	1749.0	1844.0	3498.0	3688.0
707	1749.2	1844.2	3498.4	3688.4
708	1749.4	1844.4	3498.8	3688.8
709	1749.6	1844.6	3499.2	3689.2
710	1749.8	1844.8	3499.6	3689.6
711	1750.0	1845.0	3500.0	3690.0
712	1750.2	1845.2	3500.4	3690.4
713	1750.4	1845.4	3500.8	3690.8
714	1750.6	1845.6	3501.2	3691.2
715	1750.8	1845.8	3501.6	3691.6
716	1751.0	1846.0	3502.0	3692.0
717	1751.2	1846.2	3502.4	3692.4
718	1751.4	1846.4	3502.8	3692.8
719	1751.6	1846.6	3503.2	3693.2
720	1751.8	1846.8	3503.6	3693.6
721	1752.0	1847.0	3504.0	3694.0
722	1752.2	1847.2	3504.4	3694.4
723	1752.4	1847.4	3504.8	3694.8
724	1752.6	1847.6	3505.2	3695.2
725	1752.8	1847.8	3505.6	3695.6
726	1753.0	1848.0	3506.0	3696.0
727	1753.2	1848.2	3506.4	3696.4
728	1753.4	1848.4	3506.8	3696.8
729	1753.6	1848.6	3507.2	3697.2
730	1753.8	1848.8	3507.6	3697.6
731	1754.0	1849.0	3508.0	3698.0
732	1754.2	1849.2	3508.4	3698.4
733	1754.4	1849.4	3508.8	3698.8
734	1754.6	1849.6	3509.2	3699.2
735	1754.8	1849.8	3509.6	3699.6
736	1755.0	1850.0	3510.0	3700.0
737	1755.2	1850.2	3510.4	3700.4
738	1755.4	1850.4	3510.8	3700.8
739	1755.6	1850.6	3511.2	3701.2
740	1755.8	1850.8	3511.6	3701.6
741	1756.0	1851.0	3512.0	3702.0
742	1756.2	1851.2	3512.4	3702.4
743	1756.4	1851.4	3512.8	3702.8
744	1756.6	1851.6	3513.2	3703.2
745	1756.8	1851.8	3513.6	3703.6
746	1757.0	1852.0	3514.0	3704.0
747	1757.2	1852.2	3514.4	3704.4
748	1757.4	1852.4	3514.8	3704.8
749	1757.6	1852.6	3515.2	3705.2
750	1757.8	1852.8	3515.6	3705.6
751	1758.0	1853.0	3516.0	3706.0
752	1758.2	1853.2	3516.4	3706.4
753	1758.4	1853.4	3516.8	3706.8
754	1758.6	1853.6	3517.2	3707.2
755	1758.8	1853.8	3517.6	3707.6
756	1759.0	1854.0	3518.0	3708.0
757	1759.2	1854.2	3518.4	3708.4
758	1759.4	1854.4	3518.8	3708.8
759	1759.6	1854.6	3519.2	3709.2
760	1759.8	1854.8	3519.6	3709.6
761	1760.0	1855.0	3520.0	3710.0
762	1760.2	1855.2	3520.4	3710.4
763	1760.4	1855.4	3520.8	3710.8
764	1760.6	1855.6	3521.2	3711.2
765	1760.8	1855.8	3521.6	3711.6
766	1761.0	1856.0	3522.0	3712.0
767	1761.2	1856.2	3522.4	3712.4
768	1761.4	1856.4	3522.8	3712.8
769	1761.6	1856.6	3523.2	3713.2
770	1761.8	1856.8	3523.6	3713.6
771	1762.0	1857.0	3524.0	3714.0
772	1762.2	1857.2	3524.4	3714.4
773	1762.4	1857.4	3524.8	3714.8
774	1762.6	1857.6	3525.2	3715.2
775	1762.8	1857.8	3525.6	3715.6
776	1763.0	1858.0	3526.0	3716.0
777	1763.2	1858.2	3526.4	3716.4
778	1763.4	1858.4	3526.8	3716.8
779	1763.6	1858.6	3527.2	3717.2
780	1763.8	1858.8	3527.6	3717.6
781	1764.0	1859.0	3528.0	3718.0
782	1764.2	1859.2	3528.4	3718.4
783	1764.4	1859.4	3528.8	3718.8
784	1764.6	1859.6	3529.2	3719.2
785	1764.8	1859.8	3529.6	3719.6
786	1765.0	1860.0	3530.0	3720.0
787	1765.2	1860.2	3530.4	3720.4
788	1765.4	1860.4	3530.8	3720.8
789	1765.6	1860.6	3531.2	3721.2
790	1765.8	1860.8	3531.6	3721.6
791	1766.0	1861.0	3532.0	3722.0
792	1766.2	1861.2	3532.4	3722.4
793	1766.4	1861.4	3532.8	3722.8
794	1766.6	1861.6	3533.2	3723.2
795	1766.8	1861.8	3533.6	3723.6
796	1767.0	1862.0	3534.0	3724.0
797	1767.2	1862.2	3534.4	3724.4
798	1767.4	1862.4	3534.8	3724.8
799	1767.6	1862.6	3535.2	3725.2
800	1767.8	1862.8	3535.6	3725.6
801	1768.0	1863.0	3536.0	3726.0
802	1768.2	1863.2	3536.4	3726.4
803	1768.4	1863.4	3536.8	3726.8
804	1768.6	1863.6	3537.2	3727.2
805	1768.8	1863.8	3537.6	3727.6
806	1769.0	1864.0	3538.0	3728.0
807	1769.2	1864.2	3538.4	3728.4
808	1769.4	1864.4	3538.8	3728.8
809	1769.6	1864.6	3539.2	3729.2
810	1769.8	1864.8	3539.6	3729.6
811	1770.0	1865.0	3540.0	3730.0
812	1770.2	1865.2	3540.4	3730.4
813	1770.4	1865.4	3540.8	3730.8
814	1770.6	1865.6	3541.2	3731.2
815	1770.8	1865.8	3541.6	3731.6
816	1771.0	1866.0	3542.0	3732.0
817	1771.2	1866.2	3542.4	3732.4
818	1771.4	1866.4	3542.8	3732.8
819	1771.6	1866.6	3543.2	3733.2
820	1771.8	1866.8	3543.6	3733.6
821	1772.0	1867.0	3544.0	3734.0
822	1772.2	1867.2	3544.4	3734.4
823	1772.4	1867.4	3544.8	3734.8
824	1772.6	1867.6	3545.2	3735.2
825	1772.8	1867.8	3545.6	3735.6
826	1773.0	1868.0	3546.0	3736.0
827	1773.2	1868.2	3546.4	3736.4
828	1773.4	1868.4	3546.8	3736.8
829	1773.6	1868.6	3547.2	3737.2
830	1773.8	1868.8	3547.6	3737.6
831	1774.0	1869.0	3548.0	3738.0
832	1774.2	1869.2	3548.4	3738.4
833	1774.4	1869.4	3548.8	3738.8
834	1774.6	1869.6	3549.2	3739.2
835	1774.8	1869.8	3549.6	3739.6
836	1775.0	1870.0	3550.0	3740.0
837	1775.2	1870.2	3550.4	3740.4
838	1775.4	1870.4	3550.8	3740.8
839	1775.6	1870.6	3551.2	3741.2
840	1775.8	1870.8	3551.6	3741.6
841	1776.0	1871.0	3552.0	3742.0
842	1776.2	1871.2	3552.4	3742.4
843	1776.4	1871.4	3552.8	3742.8
844	1776.6	1871.6	3553.2	3743.2
845	1776.8	1871.8	3553.6	3743.6
846	1777.0	1872.0	3554.0	3744.0
847	1777.2	1872.2	3554.4	3744.4
848	1777.4	1872.4	3554.8	3744.8
849	1777.6	1872.6	3555.2	3745.2
850	1777.8	1872.8	3555.6	3745.6
851	1778.0	1873.0	3556.0	3746.0
852	1778.2	1873.2	3556.4	3746.4
853	1778.4	1873.4	3556.8	3746.8
854	1778.6	1873.6	3557.2	3747.2
855	1778.8	1873.8	3557.6	3747.6
856	1779.0	1874.0	3558.0	3748.0
857	1779.2	1874.2	3558.4	3748.4
858	1779.4	1874.4	3558.8	3748.8
859	1779.6	1874.6	3559.2	3749.2
860	1779.8	1874.8	3559.6	3749.6
861	1780.0	1875.0	3560.0	3750.0
862	1780.2	1875.2	3560.4	3750.4
863	1780.4	1875.4	3560.8	3750.8
864	1780.6	1875.6	3561.2	3751.2
865	1780.8	1875.8	3561.6	3751.6
866	1781.0	1876.0	3562.0	3752.0
867	1781.2	1876.2	3562.4	3752.4
868	1781.4	1876.4	3562.8	3752.8
869	1781.6	1876.6	3563.2	3753.2
870	1781.8	1876.8	3563.6	3753.6
871	1782.0	1877.0	3564.0	3754.0
872	1782.2	1877.2	3564.4	3754.4
873	1782.4	1877.4	3564.8	3754.8
874	1782.6	1877.6	3565.2	3755.2
875	1782.8	1877.8	3565.6	3755.6
876	1783.0	1878.0	3566.0	3756.0
877	1783.2	1878.2	3566.4	3756.4
878	1783.4	1878.4	3566.8	3756.8
879	1783.6	1878.6	3567.2	3757.2
880	1783.8	1878.8	3567.6	3757.6
881	1784.0	1879.0	3568.0	3758.0
882	1784.2	1879.2	3568.4	3758.4
883	1784.4	1879.4	3568.8	3758.8
884	1784.6	1879.6	3569.2	3759.2
885	1784.8	1879.8	3569.6	3759.6

GSM1900 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
512	1850,2	1930,2	3700,4	3860,4	606	1869,0	1949,0	3738,0	3898,0	700	1887,8	1967,8	3775,6	3935,6	794	1906,6	1986,6	3813,2	3973,2
513	1850,4	1930,4	3700,8	3860,8	607	1869,2	1949,2	3738,4	3898,4	701	1888,0	1968,0	3776,0	3936,0	795	1906,8	1986,8	3813,6	3973,6
514	1850,6	1930,6	3701,2	3861,2	608	1869,4	1949,4	3738,8	3898,8	702	1888,2	1968,2	3776,4	3936,4	796	1907,0	1987,0	3814,0	3974,0
515	1850,8	1930,8	3701,6	3861,6	609	1869,6	1949,6	3739,2	3899,2	703	1888,4	1968,4	3776,8	3936,8	797	1907,2	1987,2	3814,4	3974,4
516	1851,0	1931,0	3702,0	3862,0	610	1869,8	1949,8	3739,6	3899,6	704	1888,6	1968,6	3777,2	3937,2	798	1907,4	1987,4	3814,8	3974,8
517	1851,2	1931,2	3702,4	3862,4	611	1870,0	1950,0	3740,0	3900,0	705	1888,8	1968,8	3777,6	3937,6	799	1907,6	1987,6	3815,2	3975,2
518	1851,4	1931,4	3702,8	3862,8	612	1870,2	1950,2	3740,4	3900,4	706	1889,0	1969,0	3778,0	3938,0	800	1907,8	1987,8	3815,6	3975,6
519	1851,6	1931,6	3703,2	3863,2	613	1870,4	1950,4	3740,8	3900,8	707	1889,2	1969,2	3778,4	3938,4	801	1908,0	1988,0	3816,0	3976,0
520	1851,8	1931,8	3703,6	3863,6	614	1870,6	1950,6	3741,2	3901,2	708	1889,4	1969,4	3778,8	3938,8	802	1908,2	1988,2	3816,4	3976,4
521	1852,0	1932,0	3704,0	3864,0	615	1870,8	1950,8	3741,6	3901,6	709	1889,6	1969,6	3779,2	3939,2	803	1908,4	1988,4	3816,8	3976,8
522	1852,2	1932,2	3704,4	3864,4	616	1871,0	1951,0	3742,0	3902,0	710	1889,8	1969,8	3779,6	3939,6	804	1908,6	1988,6	3817,2	3977,2
523	1852,4	1932,4	3704,8	3864,8	617	1871,2	1951,2	3742,4	3902,4	711	1890,0	1970,0	3780,0	3940,0	805	1908,8	1988,8	3817,6	3977,6
524	1852,6	1932,6	3705,2	3865,2	618	1871,4	1951,4	3742,8	3902,8	712	1890,2	1970,2	3780,4	3940,4	806	1909,0	1989,0	3818,0	3978,0
525	1852,8	1932,8	3705,6	3865,6	619	1871,6	1951,6	3743,2	3903,2	713	1890,4	1970,4	3780,8	3940,8	807	1909,2	1989,2	3818,4	3978,4
526	1853,0	1933,0	3706,0	3866,0	620	1871,8	1951,8	3743,6	3903,6	714	1890,6	1970,6	3781,2	3941,2	808	1909,4	1989,4	3818,8	3978,8
527	1853,2	1933,2	3706,4	3866,4	621	1872,0	1952,0	3744,0	3904,0	715	1890,8	1970,8	3781,6	3941,6	809	1909,6	1989,6	3819,2	3979,2
528	1853,4	1933,4	3706,8	3866,8	622	1872,2	1952,2	3744,4	3904,4	716	1891,0	1971,0	3782,0	3942,0	810	1909,8	1989,8	3819,6	3979,6
529	1853,6	1933,6	3707,2	3867,2	623	1872,4	1952,4	3744,8	3904,8	717	1891,2	1971,2	3782,4	3942,4					
530	1853,8	1933,8	3707,6	3867,6	624	1872,6	1952,6	3745,2	3905,2	718	1891,4	1971,4	3782,8	3942,8					
531	1854,0	1934,0	3708,0	3868,0	625	1872,8	1952,8	3745,6	3905,6	719	1891,6	1971,6	3783,2	3943,2					
532	1854,2	1934,2	3708,4	3868,4	626	1873,0	1953,0	3746,0	3906,0	720	1891,8	1971,8	3783,6	3943,6					
533	1854,4	1934,4	3708,8	3868,8	627	1873,2	1953,2	3746,4	3906,4	721	1892,0	1972,0	3784,0	3944,0					
534	1854,6	1934,6	3709,2	3869,2	628	1873,4	1953,4	3746,8	3906,8	722	1892,2	1972,2	3784,4	3944,4					
535	1854,8	1934,8	3709,6	3869,6	629	1873,6	1953,6	3747,2	3907,2	723	1892,4	1972,4	3784,8	3944,8					
536	1855,0	1935,0	3710,0	3870,0	630	1873,8	1953,8	3747,6	3907,6	724	1892,6	1972,6	3785,2	3945,2					
537	1855,2	1935,2	3710,4	3870,4	631	1874,0	1954,0	3748,0	3908,0	725	1892,8	1972,8	3785,6	3945,6					
538	1855,4	1935,4	3710,8	3870,8	632	1874,2	1954,2	3748,4	3908,4	726	1893,0	1973,0	3786,0	3946,0					
539	1855,6	1935,6	3711,2	3871,2	633	1874,4	1954,4	3748,8	3908,8	727	1893,2	1973,2	3786,4	3946,4					
540	1855,8	1935,8	3711,6	3871,6	634	1874,6	1954,6	3749,2	3909,2	728	1893,4	1973,4	3786,8	3946,8					
541	1856,0	1936,0	3712,0	3872,0	635	1874,8	1954,8	3749,6	3909,6	729	1893,6	1973,6	3787,2	3947,2					
542	1856,2	1936,2	3712,4	3872,4	636	1875,0	1955,0	3750,0	3910,0	730	1893,8	1973,8	3787,6	3947,6					
543	1856,4	1936,4	3712,8	3872,8	637	1875,2	1955,2	3750,4	3910,4	731	1894,0	1974,0	3788,0	3948,0					
544	1856,6	1936,6	3713,2	3873,2	638	1875,4	1955,4	3750,8	3910,8	732	1894,2	1974,2	3788,4	3948,4					
545	1856,8	1936,8	3713,6	3873,6	639	1875,6	1955,6	3751,2	3911,2	733	1894,4	1974,4	3788,8	3948,8					
546	1857,0	1937,0	3714,0	3874,0	640	1875,8	1955,8	3751,6	3911,6	734	1894,6	1974,6	3789,2	3949,2					
547	1857,2	1937,2	3714,4	3874,4	641	1876,0	1956,0	3752,0	3912,0	735	1894,8	1974,8	3789,6	3949,6					
548	1857,4	1937,4	3714,8	3874,8	642	1876,2	1956,2	3752,4	3912,4	736	1895,0	1975,0	3790,0	3950,0					
549	1857,6	1937,6	3715,2	3875,2	643	1876,4	1956,4	3752,8	3912,8	737	1895,2	1975,2	3790,4	3950,4					
550	1857,8	1937,8	3715,6	3875,6	644	1876,6	1956,6	3753,2	3913,2	738	1895,4	1975,4	3790,8	3950,8					
551	1858,0	1938,0	3716,0	3876,0	645	1876,8	1956,8	3753,6	3913,6	739	1895,6	1975,6	3791,2	3951,2					
552	1858,2	1938,2	3716,4	3876,4	646	1877,0	1957,0	3754,0	3914,0	740	1895,8	1975,8	3791,6	3951,6					
553	1858,4	1938,4	3716,8	3876,8	647	1877,2	1957,2	3754,4	3914,4	741	1896,0	1976,0	3792,0	3952,0					
554	1858,6	1938,6	3717,2	3877,2	648	1877,4	1957,4	3754,8	3914,8	742	1896,2	1976,2	3792,4	3952,4					
555	1858,8	1938,8	3717,6	3877,6	649	1877,6	1957,6	3755,2	3915,2	743	1896,4	1976,4	3792,8	3952,8					
556	1859,0	1939,0	3718,0	3878,0	650	1877,8	1957,8	3755,6	3915,6	744	1896,6	1976,6	3793,2	3953,2					
557	1859,2	1939,2	3718,4	3878,4	651	1878,0	1958,0	3756,0	3916,0	745	1896,8	1976,8	3793,6	3953,6					
558	1859,4	1939,4	3718,8	3878,8	652	1878,2	1958,2	3756,4	3916,4	746	1897,0	1977,0	3794,0	3954,0					
559	1859,6	1939,6	3719,2	3879,2	653	1878,4	1958,4	3756,8	3916,8	747	1897,2	1977,2	3794,4	3954,4					
560	1859,8	1939,8	3719,6	3879,6	654	1878,6	1958,6	3757,2	3917,2	748	1897,4	1977,4	3794,8	3954,8					
561	1860,0	1940,0	3720,0	3880,0	655	1878,8	1958,8	3757,6	3917,6	749	1897,6	1977,6	3795,2	3955,2					
562	1860,2	1940,2	3720,4	3880,4	656	1879,0	1959,0	3758,0	3918,0	750	1897,8	1977,8	3795,6	3955,6					
563	1860,4	1940,4	3720,8	3880,8	657	1879,2	1959,2	3758,4	3918,4	751	1898,0	1978,0	3796,0	3956,0					
564	1860,6	1940,6	3721,2	3881,2	658	1879,4	1959,4	3758,8	3918,8	752	1898,2	1978,2	3796,4	3956,4					
565	1860,8	1940,8	3721,6	3881,6	659	1879,6	1959,6	3759,2	3919,2	753	1898,4	1978,4	3796,8	3956,8					
566	1861,0	1941,0	3722,0	3882,0	660	1879,8	1959,8	3759,6	3919,6	754	1898,6	1978,6	3797,2	3957,2					
567	1861,2	1941,2	3722,4	3882,4	661	1880,0	1960,0	3760,0	3920,0	755	1898,8	1978,8	3797,6	3957,6					
568	1861,4	1941,4	3722,8	3882,8	662	1880,2	1960,2	3760,4	3920,4	756	1899,0	1979,0	3798,0	3958,0					
569	1861,6	1941,6	3723,2	3883,2	663	1880,4	1960,4	3760,8	3920,8	757	1899,2	1979,2	3798,4	3958,4					
570	1861,8	1941,8	3723,6	3883,6	664	1880,6	1960,6	3761,2	3921,2	758	1899,4	1979,4	3798,8	3958,8					
571	1862,0	1942,0	3724,0	3884,0	665	1880,8	1960,8	3761,6	3921,6	759	1899,6	1979,6	3799,2	3959,2					
572	1862,2	1942,2	3724,4	3884,4	666	1881,0	1961,0	3762,0	3922,0	760	1899,8	1979,8	3799,6	3959,6					
573	1862,4	1942,4	3724,8	3884,8	667	1881,2	1961,2	3762,4	3922,4	761	1900,0	1980,0	3800,0	3960,0					
574	1862,6	1942,6	3725,2	3885,2	668	1881,4	1961,4	3762,8	3922,8	762	1900,2	1980,2	3800,4	3960,4					
575	1862,8	1942,8	3725,6	3885,6	669	1881,6	1961,6	3763,2	3923,2	763	1900,4	1980,4	3800,8	3960,8					
576	1863,0	1943,0	3726,0	3886,0	670	1881,8	1961,8	3763,6	3923,6	764	1900,6	1980,6	3801,2	3961,2					
577	1863,2	1943,2	3726,4	3886,4	671	1882,0	1962,0	3764,0	3924,0	765	1900,8	1980,8	3801,6	3961,6					
578	1863,4	1943,4	3726,8	3886,8	672	1882,2	1962,2	3764,4	3924,4	766	1901,0	1981,0	3802,0	3962,0					
579	1863,6	1943,6	3727,2	3887,2	673	1882,4	1962,4	3764,8	3924,8	767	1901,2	1981,2	3802,4	3962,4					
580	1863,8	1943,8	3727,6	3887,6	674	1882,6	1962,6	3765,2	3925,2	768	1901,4	1981,4	3802,8	3962,8					
581	1864,0	1944,0	3728,0	3888,0	675	1882,8	1962,8	3765,6	3925,6	769	1901,6	1981,6	3803,2	3963,2					
582	1864,2	1944,2	3728,4	3888,4	676	1883,0	1963,0	3766,0	3926,0	770	1901,8	1981,8	3803,6	3963,6					
583	1864,4	1944,4	3728,8	3888,8	677	1883,2	1963,2	3766,4	3926,4	771	1902,0	1982,0	3804,0	3964,0					
584	1864,6	1944,6	3729,2	3889,2	678	1883,4	1963,4	3766,8	3926,8	772	1902,2	1982,2	3804,4	3964,4					
585	1864,8	1944,8	3729,6	3889,6	679	1883,6	1963,6	3767,2	3927,2	773	1902,4	1982,4	3804,8	3964,8					
586	1865,0	1945,0	3730,0	3890,0	680	1883,8	1963,8	3767,6	3927,6	774	1902,6	1982,6	3805,2	3965,2					
587	1865,2	1945,2	3730,4	3890,4	681	1884,0	1964,0	3768,0	3928,0	775	1902,8	1982,8	3805,6	3965,6					
588	1865,4	1945,4	3730,8	3890,8	682	1884,2	1964,2	3768,4	3928,4	776	1903,0	1983,0	3806,0	3966,0					
589	1865,6	1945,6	3731,2	3891,2	683	1884,4	1964,4	3768,8	3928,8	777	1903,2	1983,2	3806,4	3966,4					
590	1865,8	1945,8	3731,6	3891,6	684	1884,6	1964,6	3769,2	3929,2	778	1903,4	1983,4	3806,8	3966,8					
591	1866,0	1946,0	3732,0	3892,0	685	1884,8	1964,8	3769,6	3929,6	779	1903,6	1983,6	3807,2	3967,2					
592	1866,2	1946,2	3732,4	3892,4	686	1885,0	1965,0	3770,0	3930,0	780	1903,8	1983,8	3807,6	3967,6					
593	1866,4	1946,4	3732,8	3892,8	687	1885,2	1965,2	3770,4	3930,4	781	1904,0	1984,0	3808,0	3968,0					
594	1866,6	1946,6	3733,2	3893,2	688	1885,4	1965,4	3770,8	3930,8	782	1904,2	1984,2	3808,4	3968,4					
595	1866,8	1946,8	3733,6	3893,6	689	1885,6	1965,6	3771,2	3931,2	783	1904,4	1984,4	3808,8	3968,8					
596	1867,0	1947,0	3734,0	3894,0	690	1885,8	1965,8	3771,6	3931,6	784	1904,6	1984,6	3809,2	3969,2					
597	1867,2	1947,2	3734,4	3894,4	691	1886,0	1966,0	3772,0	3932,0	785	1904,8	1984,8	3809,6	3969,6					
598	1867,4	1947,4	3734,8	3894,8	692	1886,2	1966,2	3772,4	3932,4	786	1905,0	1985,0	3810,0	3970,0					
599	1867,6	1947,6	3735,2	3895,2	693	1886,4	1966,4	3772,8	3932,8	787	1905,2	1985,2	3810,4	3970,4					
600	1867,8	1947,8	3735,6	3895,6	694	1886,6	1966,6	3773,2	3933,2	788	1905,4	1985,4	3810,8	3970,8					
601	1868,0	1948,0	3736,0	3896,0	695	1886,8	1966,8	3773,6	3933,6	789	1905,6	1985,6	3811,2	3971,2					
602	1868,2	1948,2	3736,4	3896,4	696	1887,0	1967,0	3774,0	3934,0	790	1905,8	1985,8	3811,6	3971,6					
603	1868,4	1948,4	3736,8	3896,8	697	1887,2	1967,2	3774,4	3934,4	791	1906,0	1986,0	3812,0	3972,0					
604	1868,6	1948,6	3737,2	3897,2	698	1887,4	1967,4	3774,8	3934,8	792	1906,2	1986,2	3812,4	3972,4					
605	1868,8	1948,8	3737,6	3897,6	699	1887,6	1967,6	3775,2	3935,2	793	1906,4	1986,4	3812,8	3972,8					

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10 — Schematics

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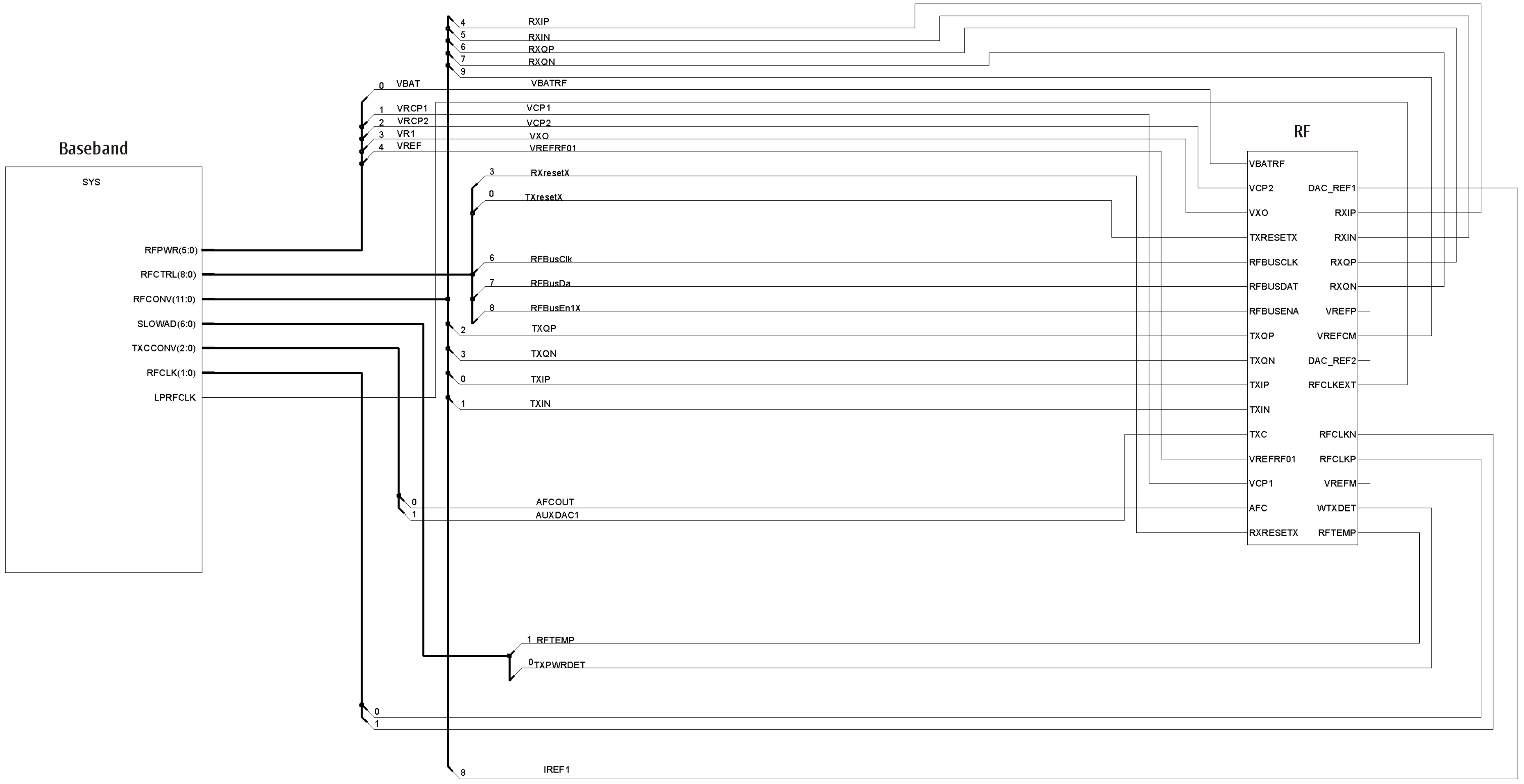
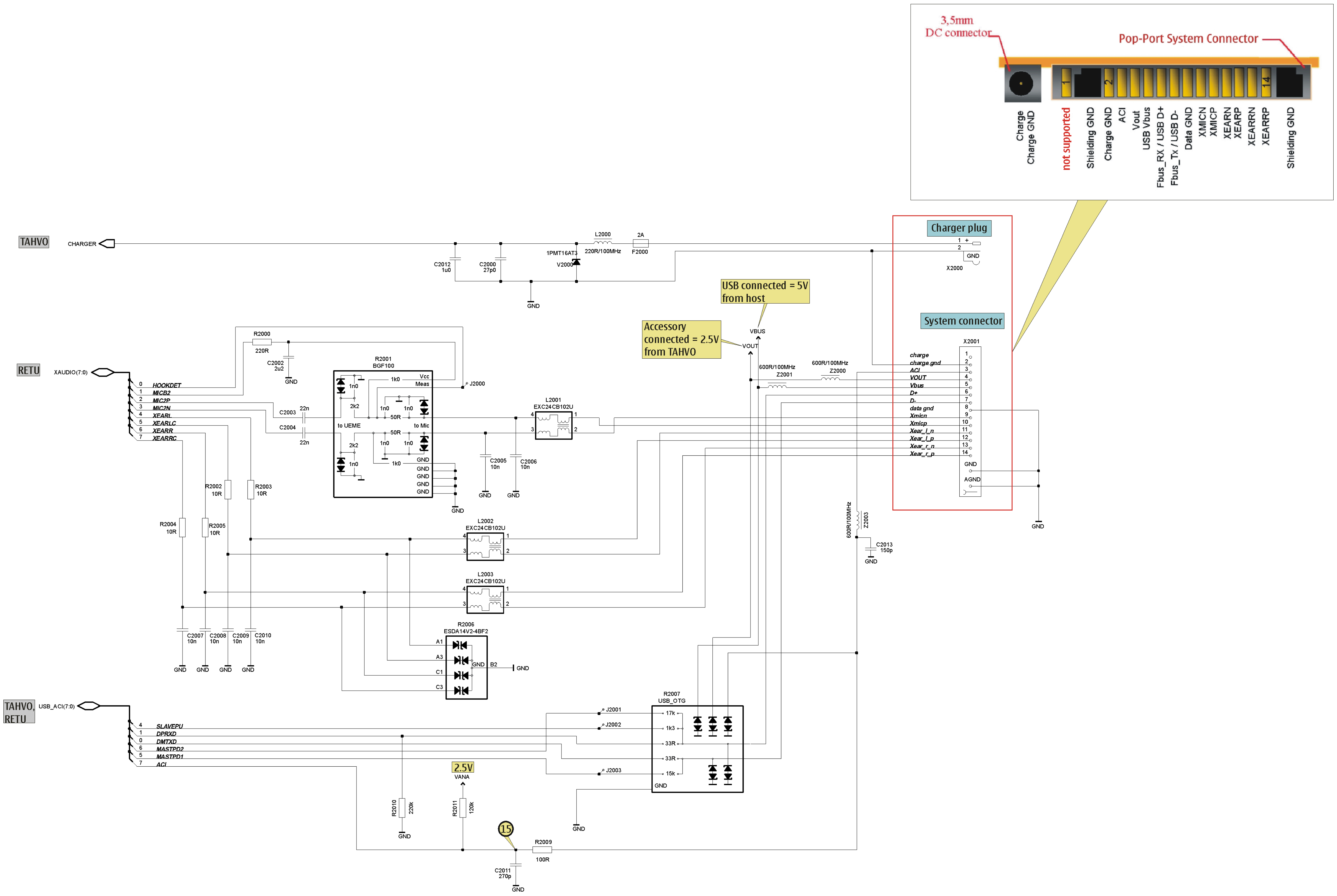
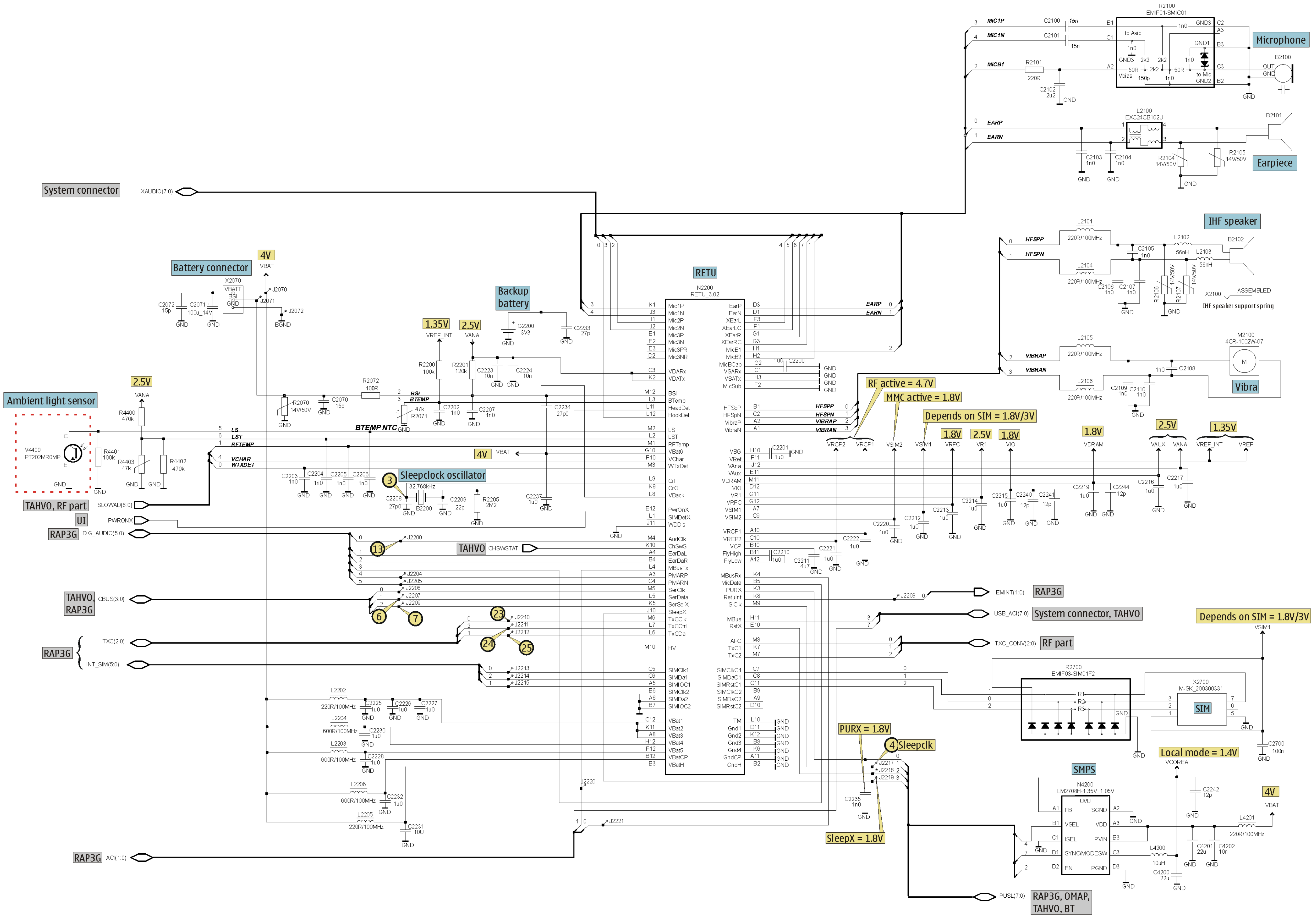
■ Baseband - RF connections


Baseband
SYS
RFPWR(5:0)
RFCTRL(8:0)
RFCONV(11:0)
SLOWAD(6:0)
TXCCONV(2:0)
RFCLK(1:0)
LPRFCLK
4 RXIP
5 RXIN
6 RXQP
7 RXQN
9 VBATRF
0 VBAT
1 VRCP1 VCP1
2 VRCP2 VCP2
3 VR1 VXO
4 VREF VREFRF01
3 RXresetX
0 TXresetX
6 RFBusClk
7 RFBusDa
8 RFBusEn1X
2 TXQP
3 TXQN
0 TXIP
1 TXIN
0 AFCOUT
1 AUXDAC1
1 RFTEMP
0 TXPWRDET
0
1
8 IREF1
RF
VBATRF
VCP2
VXO
TXRESETX
RFBUSCLK
RFBUSDAT
RFBUSENA
TXQP
TXQN
TXIP
TXIN
TXC
VREFRF01
VCP1
AFC
RXRESETX
DAC_REF1
RXIP
RXIN
RXQP
RXQN
VREFP
VREFCM
DAC_REF2
RFCLKEXT
RFCLKN
RFCLKP
VREFM
WTXDET
RFTEMP

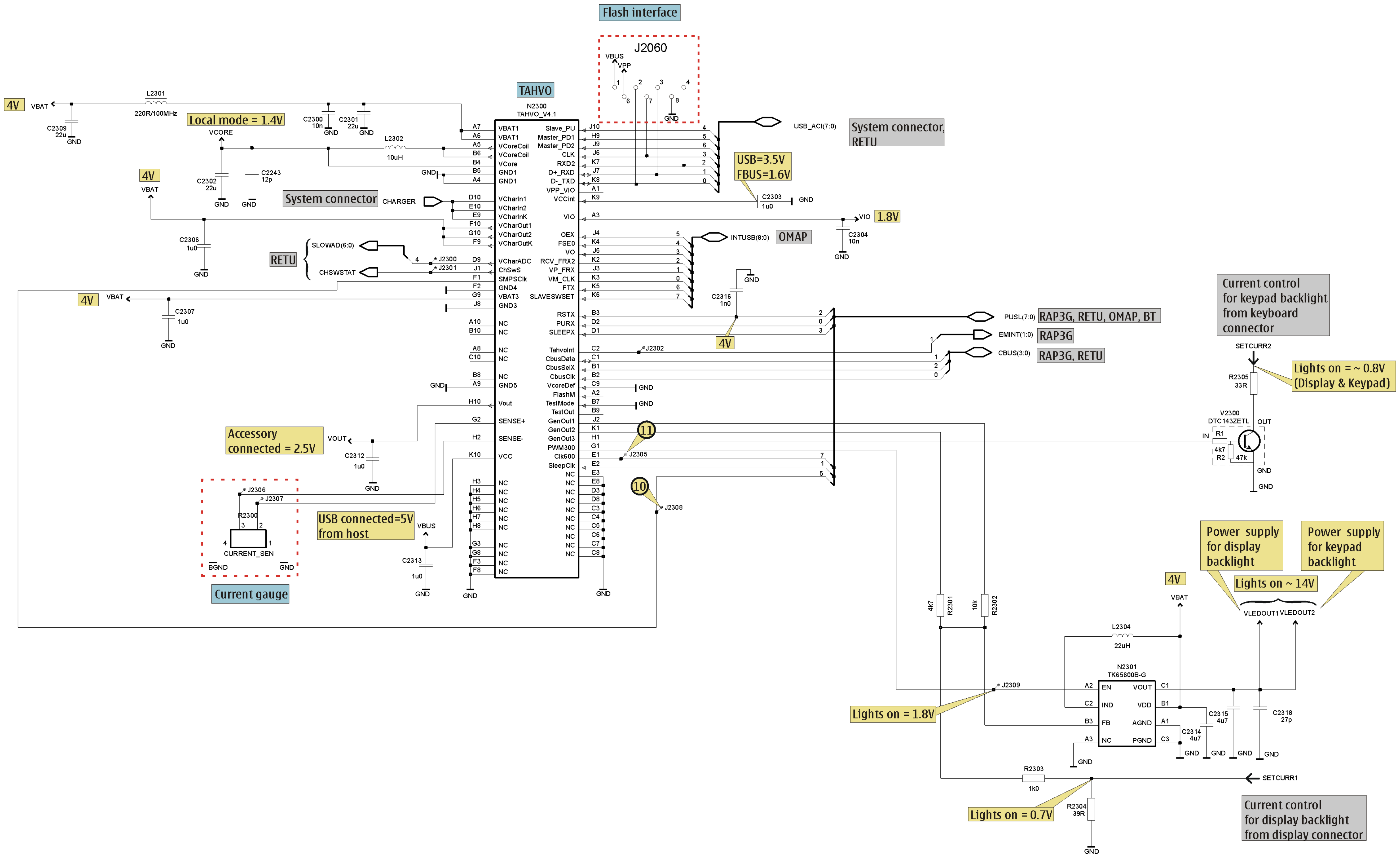
■ System connector


3,5mm
DC connector
Pop-Port System Connector
1
2
14
Charge
Charge GND
not supported
Shielding GND
Charge GND
ACI
Vout
USB Vbus
Fbus_RX / USB D+
Fbus_Tx / USB D-
Data GND
XMICN
XMICP
XEARN
XEARP
XEARRN
XEARRP
Shielding GND
TAHVO
CHARGER
C2012
1u0
C2000
27p0
1PMT16AT3
V2000
L2000
220R/100MHz
2A
F2000
GND
Charger plug
1 +
2
GND
X2000
USB connected = 5V from host
Accessory connected = 2.5V from TAHVO
VBUS
VOUT
600R/100MHz
Z2001
600R/100MHz
Z2000
System connector
X2001
charge
charge gnd
ACI
VOUT
Vbus
D+
D-
data gnd
Xmicn
Xmicp
Xear_l_n
Xear_l_p
Xear_r_n
Xear_r_p
GND
AGND
RETU
XAUDIO(7:0)
0 HOOKDET
1 MICB2
2 MIC2P
3 MIC2N
4 XEARL
5 XEARLC
6 XEARR
7 XEARRC
R2000
220R
C2002
2u2
R2001
BGF100
1k0
Vcc
Meas
J2000
1n0
2k2
50R
to UEME
to Mic
C2003
22n
C2004
22n
L2001
EXC24CB102U
C2005
10n
C2006
10n
R2002
10R
R2003
10R
R2004
10R
R2005
10R
L2002
EXC24CB102U
L2003
EXC24CB102U
C2007
10n
C2008
10n
C2009
10n
C2010
10n
R2006
ESDA14V2-4BF2
A1
A3
C1
C3
B2
600R/100MHz
Z2003
C2013
150p
TAHVO,
RETU
USB_ACI(7:0)
4 SLAVEPU
1 DPRXD
0 DMTXD
6 MASTPD2
5 MASTPD1
7 ACI
J2001
J2002
J2003
R2007
USB_OTG
17k
1k3
33R
33R
15k
2.5V
VANA
R2010
220k
R2011
120k
15
R2009
100R
C2011
270p

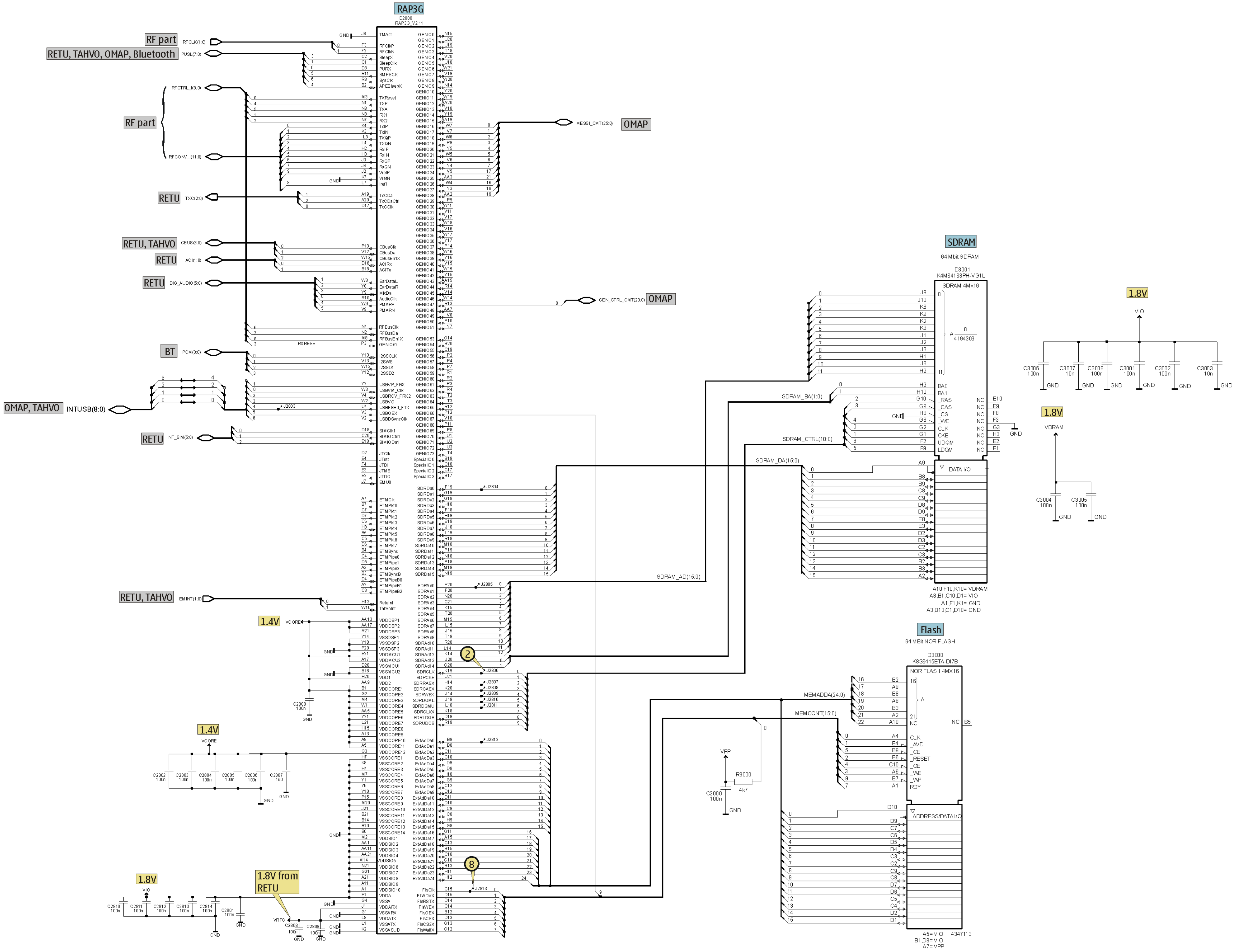
RETU, SIM, audio


System connector
XAUDIO(7:0)
Battery connector
4V
VBAT
Backup battery
1.35V
2.5V
VREF_INT
VANA
RETU
N2200
RETU_3.02
Ambient light sensor
V4400
PT202MR0MP
BTEMP NTC
Sleepclock oscillator
32.768kHz
TAHVO, RF part
SLOWAD(6:0)
UI
PWRONX
RAP3G
DIG_AUDIO(5:0)
TAHVO
CHSWSTAT
TAHVO, RAP3G
CBUS(3:0)
RAP3G
TXC(2:0)
INT_SIM(5:0)
RAP3G
ACI(1:0)
Microphone
B2100
R2100
EMIF01-SMIC01
MIC1P
MIC1N
MICB1
Earpiece
B2101
L2100
EXC24CB102U
EARP
EARN
IHF speaker
B2102
HFSPP
HFSPN
IHF speaker support spring
ASSEMBLED
X2100
Vibra
M2100
4CR-1002W-07
VIBRAP
VIBRAN
RF active = 4.7V
MMC active = 1.8V
Depends on SIM = 1.8V/3V
1.8V
2.5V
1.8V
1.8V
2.5V
1.35V
VRCP2
VRCP1
VSIM2
VSIM1
VRFC
VR1
VIO
VDRAM
VAUX
VANA
VREF_INT
VREF
RAP3G
EMINT(1:0)
System connector, TAHVO
USB_ACI(7:0)
RF part
TXC_CONV(2:0)
Depends on SIM = 1.8V/3V
VSIM1
R2700
EMIF03-SIM01F2
X2700
M-SK_200300331
SIM
PURX = 1.8V
Sleepclk
SleepX = 1.8V
Local mode = 1.4V
VCOREA
SMPS
N4200
LM2708H-1.35V_1.05V
4V
VBAT
RAP3G, OMAP, TAHVO, BT
PUSL(7:0)

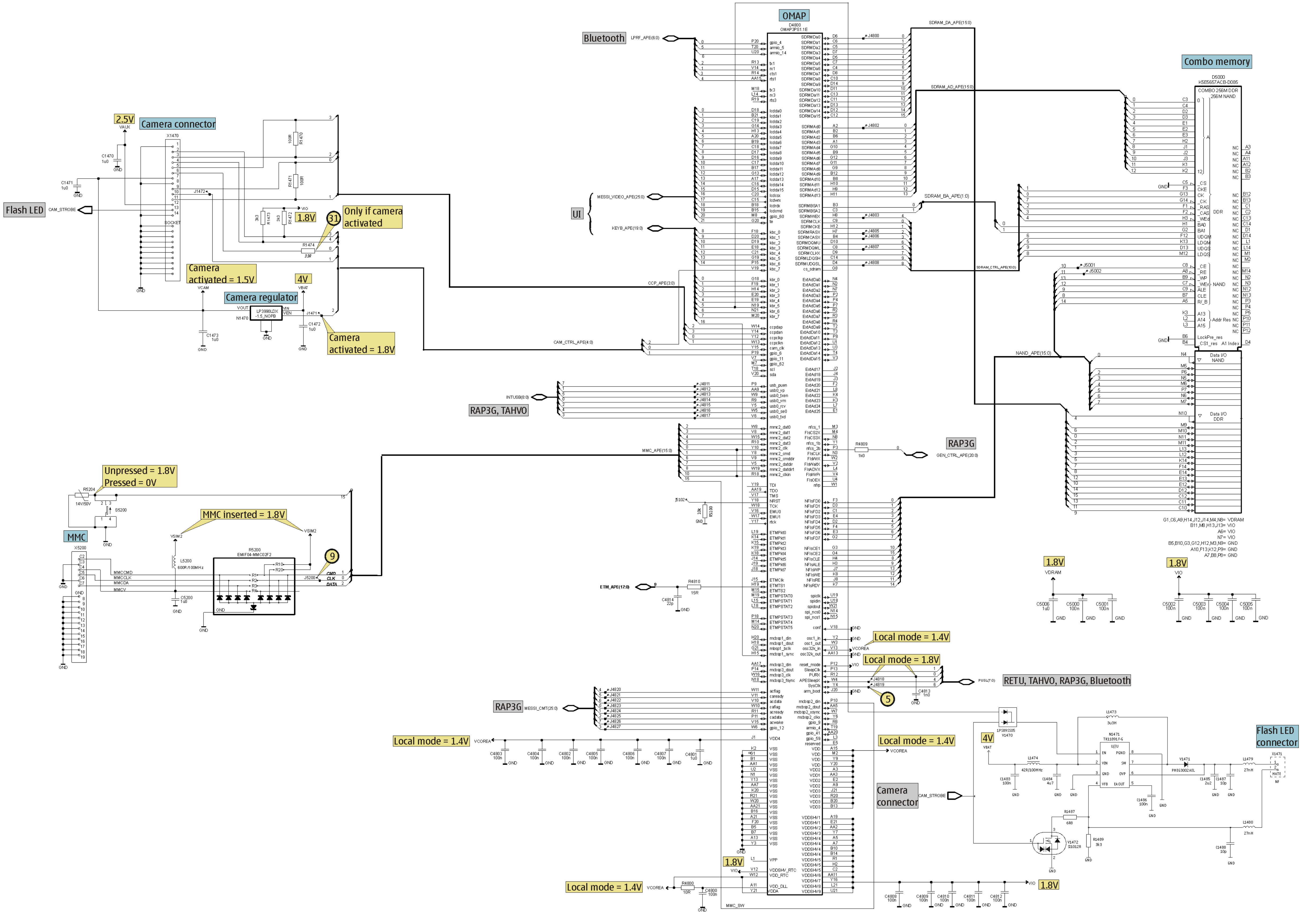
TAHVO


Flash interface
J2060
VBUS
VPP
GND
TAHVO
N2300
TAHVO_V4.1
4V
VBAT
L2301
220R/100MHz
C2309
22u
GND
Local mode = 1.4V
VCORE
C2300
10n
C2301
22u
L2302
10uH
C2302
22u
C2243
12p
4V
VBAT
System connector
CHARGER
C2306
1u0
RETU
SLOWAD(6:0)
CHSWSTAT
J2300
J2301
4V
VBAT
C2307
1u0
Accessory connected = 2.5V
VOUT
C2312
1u0
J2306
J2307
R2300
CURRENT_SEN
BGND
Current gauge
USB connected=5V from host
VBUS
C2313
1u0
VBAT1
VCoreCoil
VCore
GND1
VCharIn1
VCharIn2
VCharInK
VCharOut1
VCharOut2
VCharOutK
VCharADC
ChSwS
SMPSClk
GND4
VBAT3
GND3
NC
GND5
Vout
SENSE+
SENSE-
VCC
Slave_PU
Master_PD1
Master_PD2
CLK
RXD2
D+_RXD
D-_TXD
VPP_VIO
VCCint
VIO
OEX
FSE0
VO
RCV_FRX2
VP_FRX
VM_CLK
FTX
SLAVESWSET
RSTX
PURX
SLEEPX
TahvoInt
CbusData
CbusSelX
CbusClk
VcoreDef
FlashM
TestMode
TestOut
GenOut1
GenOut2
GenOut3
PWM300
Clk600
SleepClk
USB_ACI(7:0)
System connector, RETU
USB=3.5V
FBUS=1.6V
C2303
1u0
VIO
1.8V
C2304
10n
INTUSB(8:0)
OMAP
C2316
1n0
4V
PUSL(7:0)
RAP3G, RETU, OMAP, BT
EMINT(1:0)
RAP3G
CBUS(3:0)
RAP3G, RETU
J2302
J2305
J2308
11
10
Current control for keypad backlight from keyboard connector
SETCURR2
R2305
33R
Lights on = ~ 0.8V (Display & Keypad)
V2300
DTC143ZETL
IN
OUT
R1
4k7
R2
47k
GND
Power supply for display backlight
Power supply for keypad backlight
4V
VBAT
Lights on ~ 14V
VLEDOUT1
VLEDOUT2
L2304
22uH
N2301
TK65600B-G
EN
IND
FB
NC
VOUT
VDD
AGND
PGND
C2315
4u7
C2314
4u7
C2318
27p
4k7
R2301
10k
R2302
J2309
Lights on = 1.8V
R2303
1k0
SETCURR1
R2304
39R
Lights on = 0.7V
Current control for display backlight from display connector

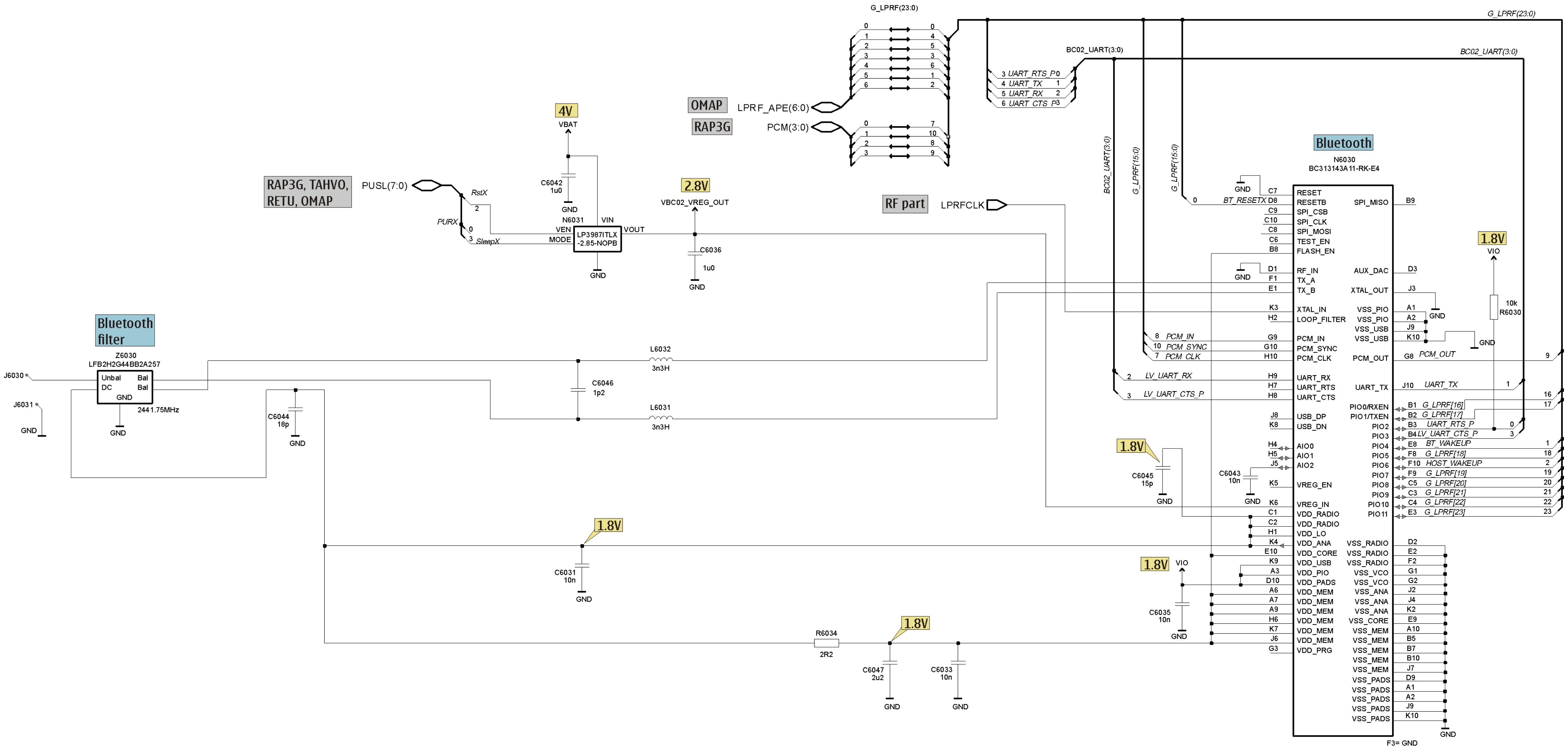
RAP3G, SDRAM, Flash


RAP3G
D2800
RAP3G_V2.11
RF part
RFCLK(1:0)
RETU, TAHVO, OMAP, Bluetooth
PUSL(7:0)
RFCTRL_I(8:0)
RF part
RFCONV_I(11:0)
MESSI_CMT(25:0)
OMAP
RETU
TXC(2:0)
RETU, TAHVO
CBUS(3:0)
RETU
ACI(1:0)
RETU
DIO_AUDIO(5:0)
GEN_CTRL_CMT(20:0)
OMAP
RXRESET
BT
PCM(3:0)
OMAP, TAHVO
INTUSB(8:0)
J2803
RETU
INT_SIM(5:0)
SDRAM_AD(15:0)
J2804
J2805
RETU, TAHVO
EMINT(1:0)
1.4V
VCORE
C2800
100n
GND
1.4V
VCORE
C2802
100n
C2803
100n
C2804
100n
C2805
100n
C2806
100n
C2807
1u0
GND
J2806
J2807
J2808
J2809
J2810
J2811
J2812
2
8
J2813
1.8V
VIO
C2810
100n
C2811
100n
C2812
100n
C2813
100n
C2814
100n
C2801
100n
GND
1.8V from
RETU
VRFC
C2808
100n
C2809
100n
SDRAM
64 Mbit SDRAM
D3001
K4M64163PH-VG1L
SDRAM 4Mx16
4194303
SDRAM_BA(1:0)
SDRAM_CTRL(10:0)
SDRAM_DA(15:0)
BA0
BA1
_RAS
_CAS
_CS
_WE
CLK
CKE
UDQM
LDQM
NC
DATA I/O
A10,F10,K10= VDRAM
A8,B1,C10,D1= VIO
A1,F1,K1= GND
A3,B10,C1,D10= GND
1.8V
VIO
C3006
100n
C3007
10n
C3008
100n
C3001
100n
C3002
100n
C3003
10n
GND
1.8V
VDRAM
C3004
100n
C3005
100n
GND
Flash
64 Mbit NOR FLASH
D3000
K8S6415ETA-DI7B
NOR FLASH 4MX16
MEMADDA(24:0)
MEMCONT(15:0)
CLK
_AVD
_CE
_RESET
_OE
_WE
_VPP
RDY
ADDRESS/DATA I/O
VPP
R3000
4k7
C3000
100n
GND
A5= VIO
B1,D8= VIO
A7= VPP
4347113

OMAP, combo memory, camera

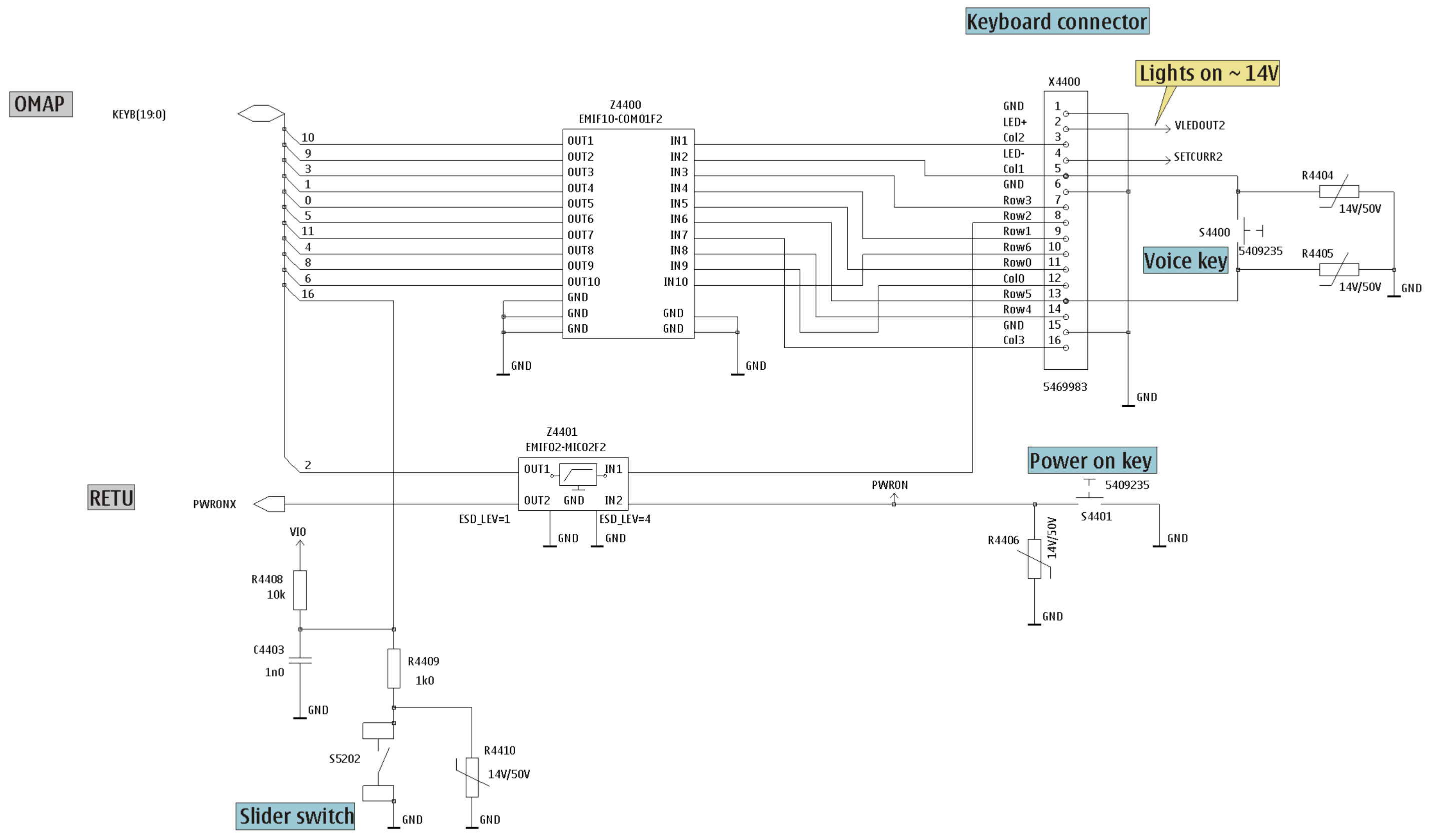

OMAP
D4800
Bluetooth
UI
Combo memory
D5000
2.5V
Camera connector
Flash LED
Only if camera activated
1.8V
31
Camera activated = 1.5V
4V
Camera regulator
Camera activated = 1.8V
RAP3G, TAHVO
RAP3G
Unpressed = 1.8V
Pressed = 0V
MMC inserted = 1.8V
MMC
9
1.8V
1.8V
Local mode = 1.4V
Local mode = 1.8V
RETU, TAHVO, RAP3G, Bluetooth
5
RAP3G
Local mode = 1.4V
4V
Local mode = 1.4V
Camera connector
Flash LED connector
1.8V
Local mode = 1.4V
1.8V

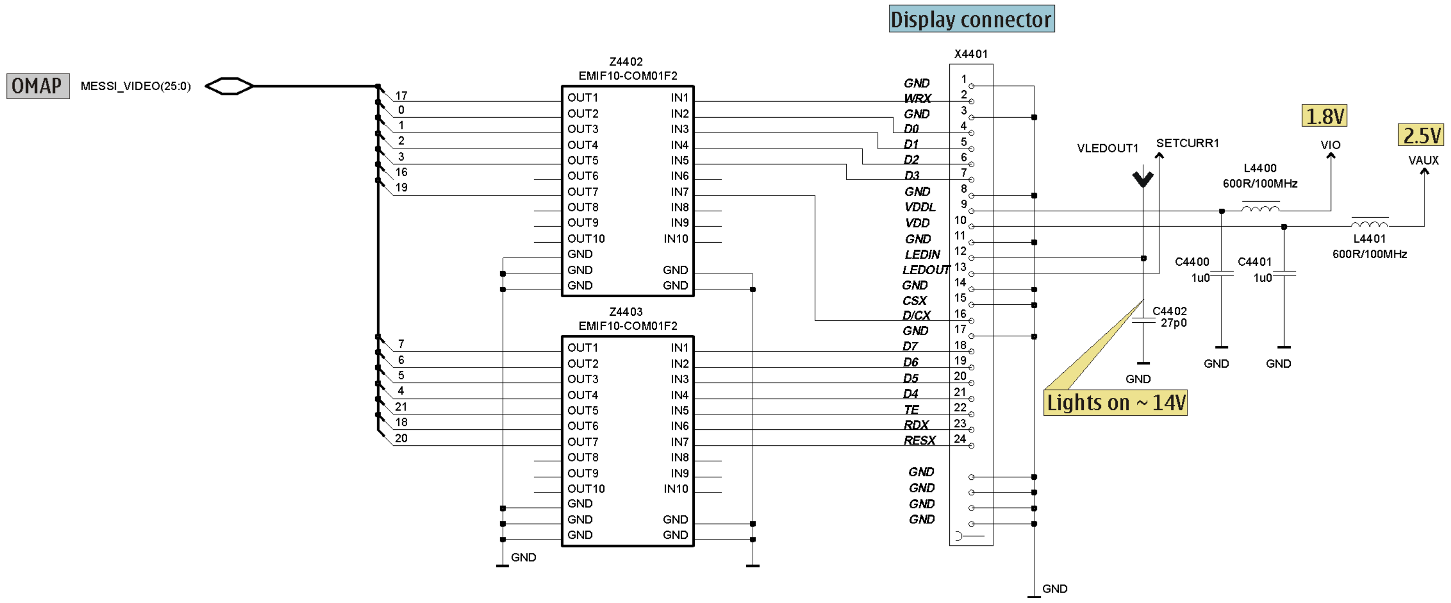
Bluetooth


G_LPRF(23:0)
BC02_UART(3:0)
OMAP
RAP3G
LPRF_APE(6:0)
PCM(3:0)
4V
VBAT
C6042
1u0
GND
N6031
VIN
VEN
MODE
LP3987ITLX
-2.85-NOPB
VOUT
2.8V
VBCO2_VREG_OUT
C6036
1u0
RAP3G, TAHVO, RETU, OMAP
PUSL(7:0)
RstX
PURX
SleepX
RF part
LPRFCLK
Bluetooth
N6030
BC313143A11-RK-E4
Bluetooth filter
Z6030
LFB2H2G44BB2A257
J6030
J6031
Unbal
DC
Bal
Bal
2441.75MHz
C6044
18p
L6032
3n3H
C6046
1p2
L6031
3n3H
1.8V
C6031
10n
R6034
2R2
C6047
2u2
C6033
10n
C6045
15p
C6043
10n
VIO
C6035
10n
10k
R6030
3 UART_RTS_P
4 UART_TX
5 UART_RX
6 UART_CTS_P
BT_RESETX
PCM_IN
PCM_SYNC
PCM_CLK
LV_UART_RX
LV_UART_CTS_P
RESET
RESETB
SPI_CSB
SPI_CLK
SPI_MOSI
TEST_EN
FLASH_EN
RF_IN
TX_A
TX_B
XTAL_IN
LOOP_FILTER
PCM_IN
PCM_SYNC
PCM_CLK
UART_RX
UART_RTS
UART_CTS
USB_DP
USB_DN
AIO0
AIO1
AIO2
VREG_EN
VREG_IN
VDD_RADIO
VDD_RADIO
VDD_LO
VDD_ANA
VDD_CORE
VDD_USB
VDD_PIO
VDD_PADS
VDD_MEM
VDD_PRG
SPI_MISO
AUX_DAC
XTAL_OUT
VSS_PIO
VSS_USB
PCM_OUT
UART_TX
PIO0/RXEN
PIO1/TXEN
PIO2
PIO3
PIO4
PIO5
PIO6
PIO7
PIO8
PIO9
PIO10
PIO11
VSS_RADIO
VSS_VCO
VSS_ANA
VSS_CORE
VSS_MEM
VSS_PADS
PCM_OUT
UART_TX
G_LPRF[16]
G_LPRF[17]
UART_RTS_P
LV_UART_CTS_P
BT_WAKEUP
G_LPRF[18]
HOST_WAKEUP
G_LPRF[19]
G_LPRF[20]
G_LPRF[21]
G_LPRF[22]
G_LPRF[23]
F3= GND

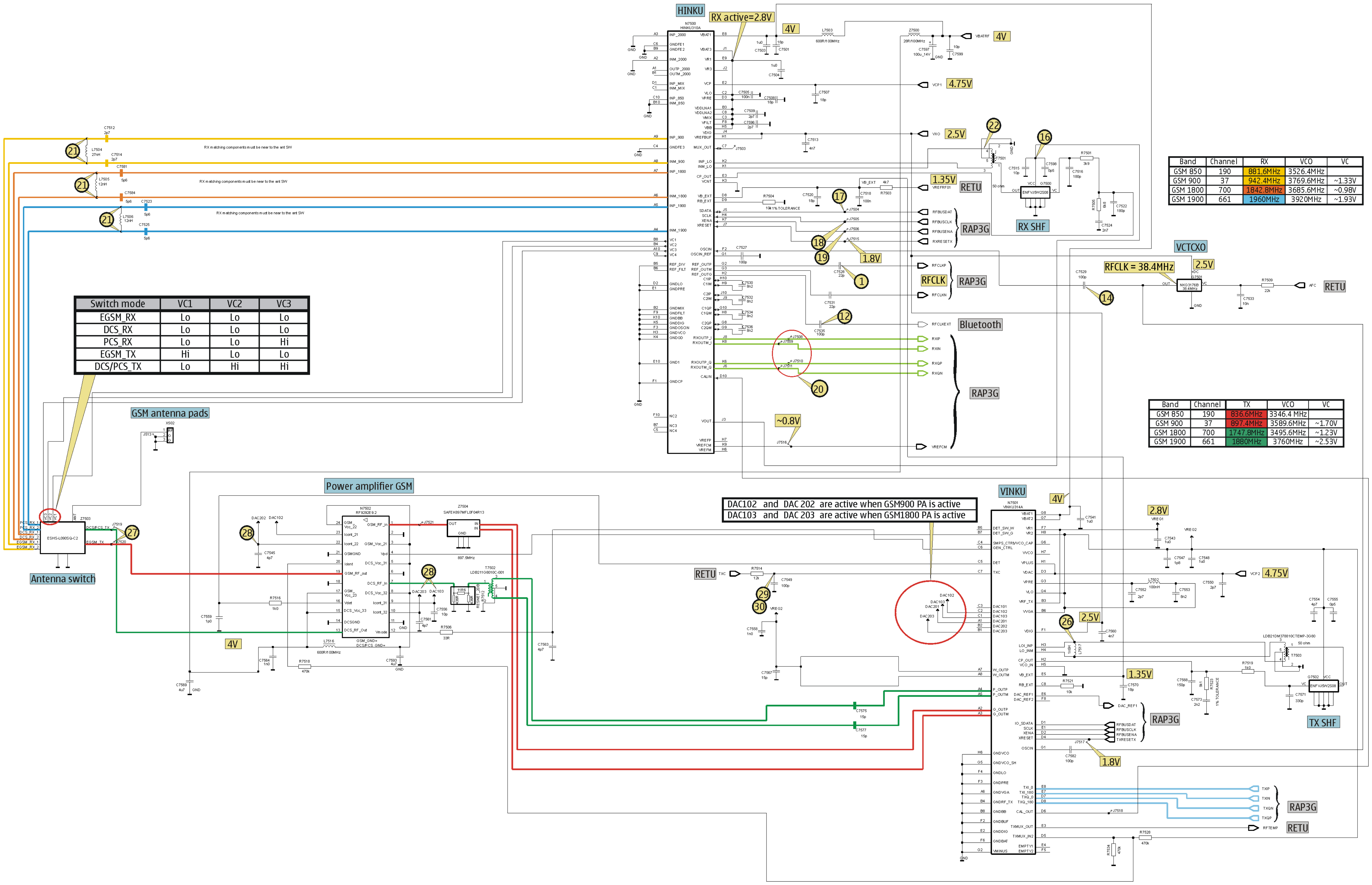
Company Confidential

B to B connections


Keyboard connector
Lights on ~ 14V
OMAP
KEYB(19:0)
Z4400
EMIF10-COM01F2
OUT1 OUT2 OUT3 OUT4 OUT5 OUT6 OUT7 OUT8 OUT9 OUT10 GND GND GND
IN1 IN2 IN3 IN4 IN5 IN6 IN7 IN8 IN9 IN10 GND GND
10 9 3 1 0 5 11 4 8 6 16
X4400
GND LED+ Col2 LED- Col1 GND Row3 Row2 Row1 Row6 Row0 Col0 Row5 Row4 GND Col3
5469983
VLEDOUT2
SETCURR2
R4404
14V/50V
S4400
5409235
Voice key
R4405
14V/50V
GND
Z4401
EMIF02-MIC02F2
OUT1 IN1 OUT2 GND IN2
ESD_LEV=1
ESD_LEV=4
2
RETU
PWRONX
PWRON
Power on key
5409235
S4401
R4406
14V/50V
VIO
R4408
10k
C4403
1n0
R4409
1k0
S5202
R4410
14V/50V
Slider switch


Display connector
OMAP
MESSI_VIDEO(25:0)
Z4402
EMIF10-COM01F2
17 0 1 2 3 16 19
Z4403
EMIF10-COM01F2
7 6 5 4 21 18 20
X4401
GND WRX GND D0 D1 D2 D3 GND VDDL VDD GND LEDIN LEDOUT GND CSX D/CX GND D7 D6 D5 D4 TE RDX RESX GND GND GND GND
VLEDOUT1
SETCURR1
L4400
600R/100MHz
1.8V
VIO
2.5V
VAUX
L4401
600R/100MHz
C4400
1u0
C4401
1u0
C4402
27p0
Lights on ~ 14V
GND

RF part


HINKU
N7500
HINKU310A
RX active=2.8V
4V
4.75V
2.5V
1.35V
1.8V
~0.8V
RETU
RAP3G
RX SHF
RFCLK
RFCLK = 38.4MHz
VCTCXO
Bluetooth
GSM antenna pads
Antenna switch
Power amplifier GSM
VINKU
N7501
2.8V
4.75V
2.5V
1.35V
1.8V
TX SHF
RX matching components must be near to the ant SW
1
12
14
16
17
18
19
20
21
22
26
27
28
29
30

Switch mode	VC1	VC2	VC3
EGSM_RX	Lo	Lo	Lo
DCS_RX	Lo	Lo	Lo
PCS_RX	Lo	Lo	Hi
EGSM_TX	Hi	Lo	Lo
DCS/PCS_TX	Lo	Hi	Hi

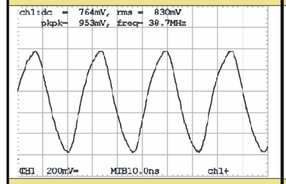
Band	Channel	RX	VCO	VC
GSM 850	190	881,6MHz	3526.4MHz	
GSM 900	37	942.4MHz	3769.6MHz	~1.33V
GSM 1800	700	1842.8MHz	3685.6MHz	~0.98V
GSM 1900	661	1960MHz	3920MHz	~1.93V

Band	Channel	TX	VCO	VC
GSM 850	190	836.6MHz	3346.4 MHz	
GSM 900	37	897.4MHz	3589.6MHz	~1.70V
GSM 1800	700	1747.8MHz	3495.6MHz	~1.23V
GSM 1900	661	1880MHz	3760MHz	~2.53V

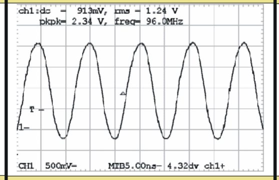
DAC102 and DAC 202 are active when GSM900 PA is active
DAC103 and DAC 203 are active when GSM1800 PA is active

Signal overview

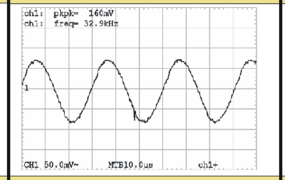
1) RFCLK at C7528



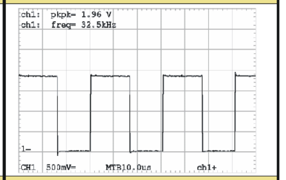
2) SDRAMCLK at J2806



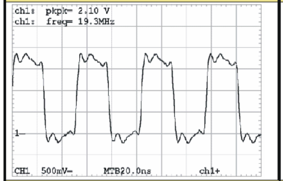
3) 32kHz at C2208



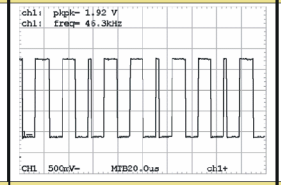
4) SLEEPCLK at J2217



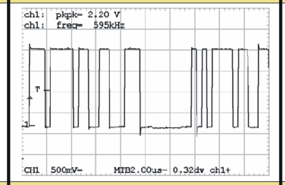
5) SYSCLK at J4819



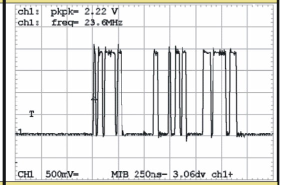
6) CBUSDATA at J2207



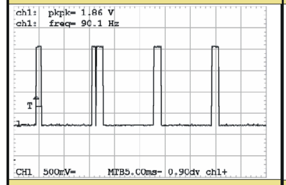
7) CBUSSELX at J2209



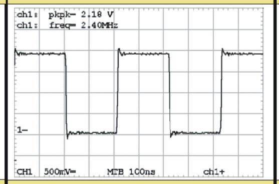
8) FLSClk at J2813



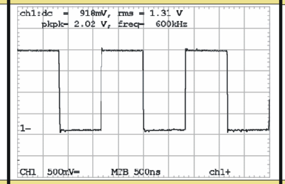
9) MMCClk at J5200



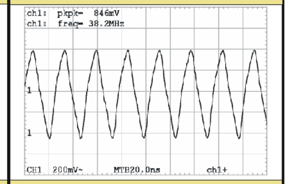
10) SMPSClk at J2308



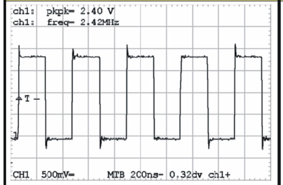
11) Clk600 at J2305



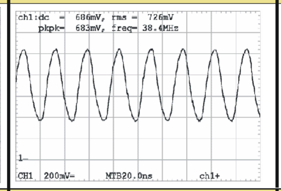
12) LPRFCLK at C7535



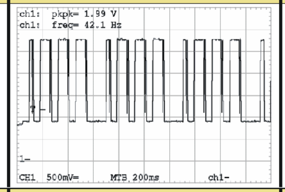
13) AUDIOCLK at J2200



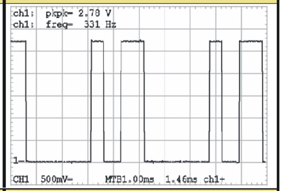
14) 38.4MHz at C7529



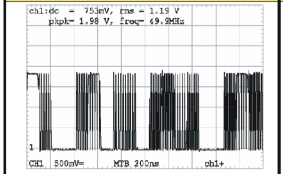
15) ACI at C2011



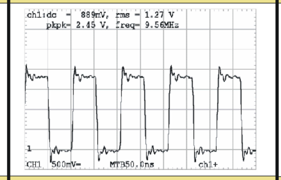
16) VR1RX at C7515



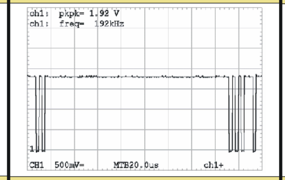
17) RFBUSDATA at J7504



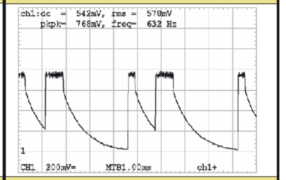
18) RFBUSCLK at J7505



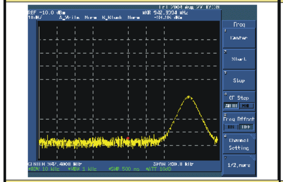
19) RFBUSEN at J7506



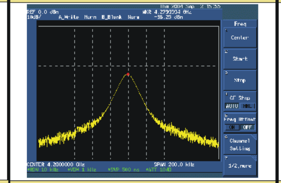
20) RXIQ at J7508 - J7511



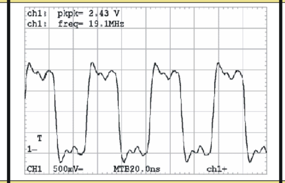
21) RX GSM at L7504 - L7506



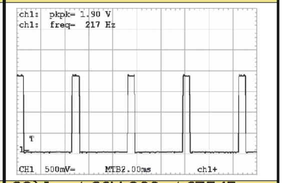
22) RX SHF at T7501



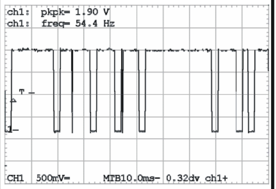
23) TXCCLK at J2210



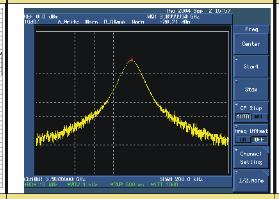
24) TXCCtrl at J2211



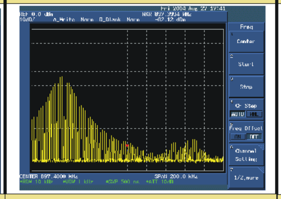
25) TXCDATA at J2212



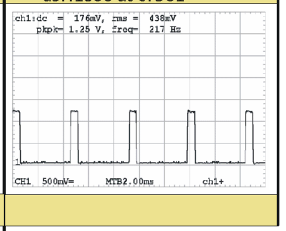
26) TX SHF at L7517



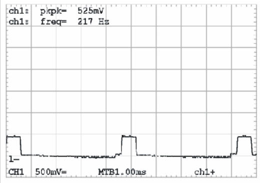
27) TX GSM at J7519 - J7520



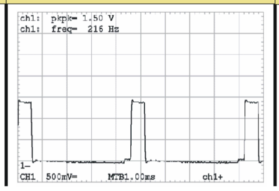
28) Icont GSM 900 at C7545 GSM1800 at C7561



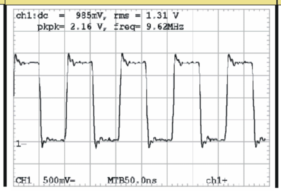
29) TXC LOW at C7549

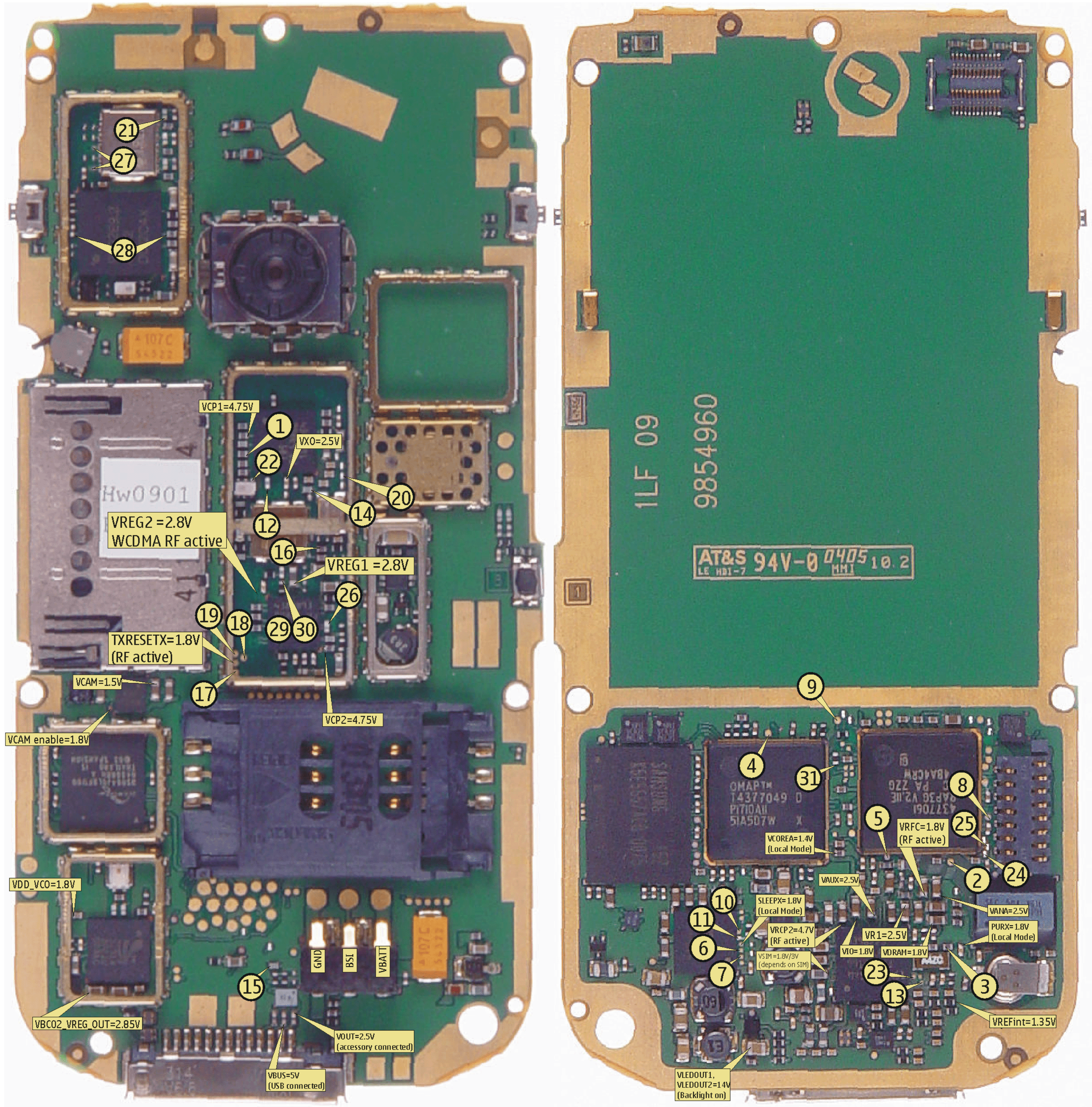


30) TXC HIGH at C7549



31) CAM_CLK at R1474





Component finder

B		C2230	E5	C4809	H7	C7561	Q4	J2306	A7	J5106	D6	N2200	C5	R5204	O3
B2200	C4	C2231	B6	C4810	G9	C7563	Q4	J2307	A7	J5107	E6	N2300	D8	R6030	D4
C		C2232	D6	C4811	F6	C7564	R3	J2308	D8	J5108	H6	N2301	B7	R6034	D2
C1470	R6	C2233	C3	C4812	E7	C7567	J6	J2309	B7	J5109	H7	N4200	D7	R7501	K6
C1471	O6	C2234	D4	C4813	F6	C7568	I7	J2802	F6	J5110	H6	N6030	C3	R7503	I6
C1472	H4	C2235	C3	C4814	H8	C7569	R4	J2803	D4	J5200	H6	N6031	C2	R7504	M7
C1473	H4	C2237	D5	C5000	E11	C7570	I6	J2804	E3	J6030	E1	N7500	M6	R7505	L6
C1483	C10	C2240	E10	C5001	E9	C7571	L10	J2805	E2	J6031	E1	N7501	J7	R7506	Q4
C1484	K8	C2241	D4	C5002	H10	C7573	I7	J2806	E4	J6034	C4	N7502	Q3	R7509	K7
C1485	K8	C2242	E6	C5003	F9	C7575	I6	J2807	E2	J7503	N7	R		R7512	P4
C1486	K8	C2243	F6	C5004	E9	C7577	I6	J2808	E2	J7504	I5	R1470	H6	R7514	K6
C1487	K11	C2244	E10	C5005	E9	C7581	S4	J2809	E2	J7505	I5	R1471	H6	R7516	R3
C1488	K10	C2300	C9	C5006	D10	C7582	I7	J2810	E3	J7506	I5	R1472	H8	R7518	Q2
C2000	C9	C2301	C9	C5200	H3	C7584	S4	J2811	E4	J7508	M7	R1473	H8	R7519	J7
C2002	D5	C2302	B7	C6031	D2	C7593	Q4	J2812	G3	J7509	L7	R1474	G6	R7521	J6
C2003	B5	C2303	E8	C6033	C4	C7596	N6	J2813	F3	J7510	L6	R1487	J9	R7523	I7
C2004	B4	C2304	C8	C6035	D4	C7597	O4	J3100	G3	J7511	M7	R1489	K8	R7528	J7
C2005	B5	C2306	D9	C6036	C3	C7598	K7	J3101	H3	J7515	H5	R2000	C5	R7534	R2
C2006	B5	C2307	D9	C6042	C3	C7599	O3	J3102	H3	J7516	L7	R2001	B5	S	
C2007	B4	C2309	B9	C6043	C2	D		J3103	H3	J7517	I5	R2002	B5	S4400	R11
C2008	D4	C2312	E9	C6044	E3	D2800	G4	J3104	G3	J7518	M7	R2003	A5	S4401	R2
C2009	D4	C2313	E9	C6045	D4	D3000	G3	J3105	G3	J7519	R3	R2004	B4	S5200	O2
C2010	A4	C2314	B9	C6046	D3	D3001	D2	J3106	H3	J7520	S3	R2005	B5	S5202	K11
C2011	C6	C2315	B7	C6047	C2	D4800	F7	J3107	D6	J7521	P2	R2006	B4	T	
C2012	C10	C2316	C8	C7501	N7	D5000	F10	J3108	D6	L		R2007	B6	T7501	L6
C2070	B7	C2318	A8	C7503	M7	F		J3109	D6	L1473	I9	R2009	C6	T7502	P3
C2071	C9	C2700	G11	C7504	M7	F2000	C10	J3110	H6	L1474	C10	R2010	D8	T7503	M8
C2072	C9	C2800	E5	C7505	L7	G		J3111	D5	L1479	L11	R2011	C6	V	
C2100	B5	C2801	H4	C7507	M6	G2200	C2	J3112	D5	L1480	L11	R2012	D5	V1470	D10
C2101	B5	C2802	F3	C7508	M6	G7500	K6	J3113	D5	L2000	C10	R2013	D4	V1471	K9
C2102	B5	C2803	E5	C7509	M6	G7501	L7	J3114	D5	L2001	B6	R2014	D4	V1472	J9
C2103	B4	C2804	E3	C7512	S4	G7502	M9	J3115	H5	L2002	B4	R2070	B7	V2000	C10
C2104	B4	C2805	G6	C7513	L6	J		J3116	H5	L2003	B4	R2071	C2	V2001	D4
C2105	B6	C2806	H4	C7514	S4	J1471	H3	J3117	H6	L2100	T7	R2072	B7	V2300	D8
C2106	B6	C2807	H4	C7515	K7	J1472	O8	J3118	H5	L2101	B6	R2100	B5	V4400	U10
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C2201	D4	C2813	E4	C7524	K5	J2003	D9	J4807	F9	L2202	E4	R2106	S5	X2700	F8
C2202	C4	C2814	F3	C7525	R4	J2060	D5	J4808	E9	L2203	E5	R2107	S5	X4400	F2
C2203	C4	C3000	F4	C7527	M6	J2070	D8	J4811	D9	L2204	E5	R2200	B4	X4401	T9
C2204	C4	C3001	G4	C7528	M6	J2071	D8	J4812	E8	L2205	C6	R2201	D4	X4402	P11
C2205	C4	C3002	F2	C7529	L7	J2072	D7	J4813	D6	L2206	E5	R2205	D4	X4403	P2
C2206	C4	C3003	G2	C7530	L7	J2200	C4	J4814	D7	L2207	E11	R2301	B7	X4404	R4
C2207	D4	C3004	C2	C7531	M6	J2204	D5	J4815	D8	L2301	B8	R2302	B7	X4405	J4
C2208	D4	C3005	E3	C7532	L7	J2205	E5	J4816	E7	L2302	C8	R2303	B7	X5200	L3
C2209	D4	C3006	D4	C7533	K7	J2206	C4	J4817	D9	L2304	B8	R2304	A7	Z	
C2210	D6	C3007	C3	C7534	M7	J2207	C8	J4818	E7	L4200	C7	R2305	E8	Z2000	B7
C2211	C7	C3008	D4	C7535	L6	J2208	C4	J4819	E5	L4201	E7	R2700	D10	Z2001	B7
C2212	C6	C4200	D7	C7536	M7	J2209	C8	J4820	G6	L4400	S7	R3000	G2	Z2003	B7
C2213	E4	C4201	E7	C7541	K7	J2210	C4	J4821	G6	L4401	T7	R4400	B4	Z4400	H3
C2214	D5	C4202	D7	C7543	K7	J2211	E3	J4822	G6	L5200	I2	R4401	C4	Z4401	G2
C2215	D5	C4400	U2	C7545	Q2	J2212	E3	J4823	G6	L6031	D2	R4402	B4	Z4402	H9
C2216	D5	C4401	T8	C7547	J7	J2213	C6	J4824	G6	L6032	D2	R4403	U10	Z4403	H10
C2217	E4	C4402	S2	C7548	J7	J2214	C6	J4825	G6	L6034	F2	R4404	Q10	Z6030	E3
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C2221	D6	C4801	E7	C7552	I7	J2218	C8	J5001	E8	L7504	S4	R4408	K10	Z7504	P3
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C2227	D6	C4807	E8	C7559	R2	J2302	C6	J5104	E6	N1470	H3	R5100	H5		
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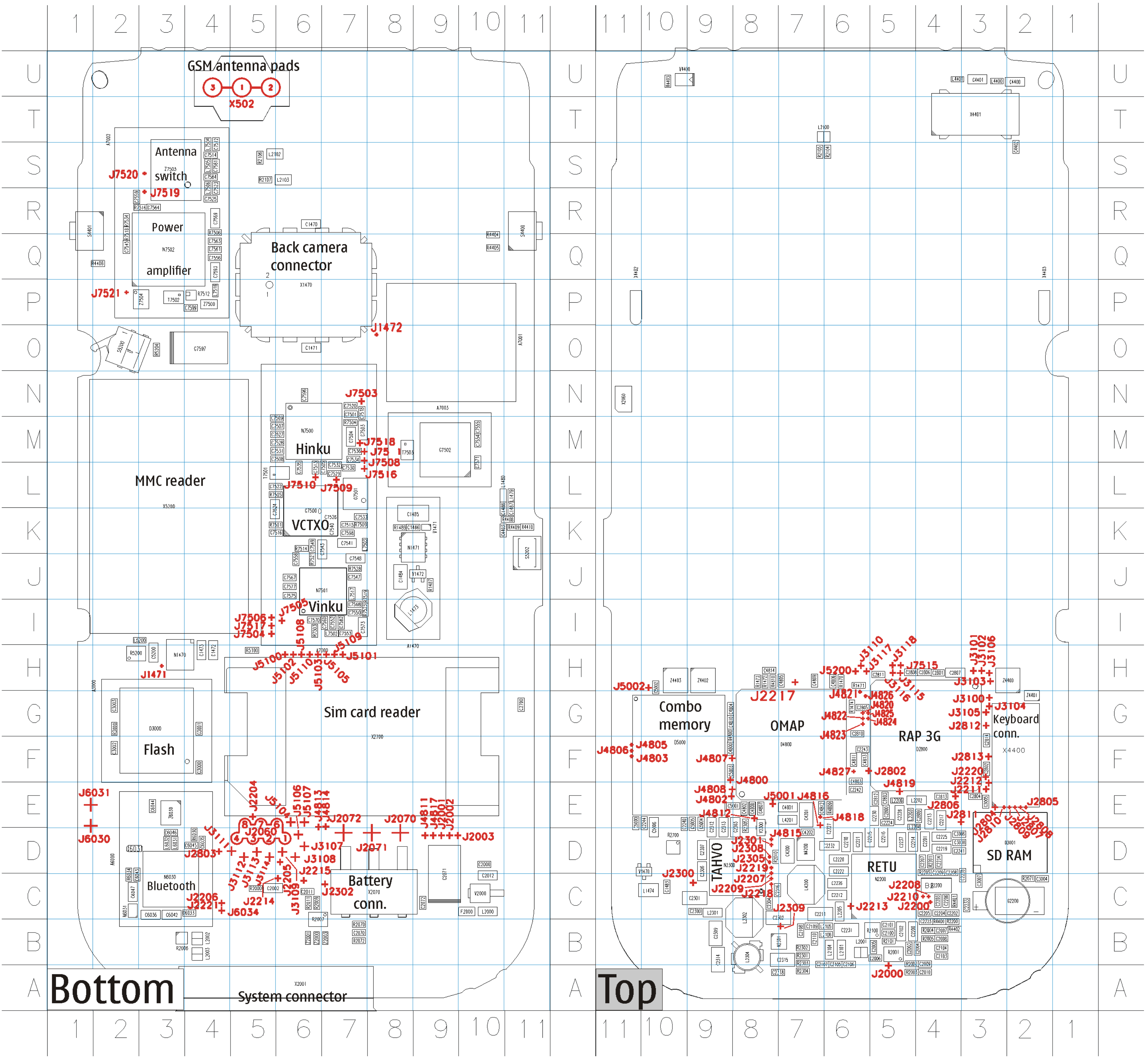
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X502
Antenna switch
J7520
J7519
Power amplifier
J7521
Back camera connector
J1472
MMC reader
J7503
Hinku
J7518
J7508
J7516
J7510
J7509
VCTXO
Vinku
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Sim card reader
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System connector
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Top
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Combo memory
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